

FLIGHT

First Aero Weekly in the World.

Founder and Editor: **STANLEY SPOONER.**

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport.

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EDITORIAL COMMENT.



E do not appear to have a monopoly of "air crises" in England. Following on a recent debate in the French Chamber on the administration of the air service, the Minister of War, General Lyautey, whose appointment is of but recent date, found it necessary to tender his resignation to the Premier. The exact grounds upon which he was forced to take this grave

The British and French Air Services.

decision have not emerged in the summaries which have been printed in the English newspapers. As a matter of fact, the real cause of his resignation arose during a secret session of the Chamber, during which he apparently refused to give certain information, on the ground that it might endanger the national defence. It is not, however, a matter of any great importance for us to know the details. It is amply clear that there is a not inconsiderable volume of opinion in France which holds that all is not well with the air service. We know that that service has been subjected to frequent reorganisation since the outbreak of war, and that these reorganisations have not always made for greater efficiency.

We also have had our troubles in the same direction, and if we knew the truth it is quite possible that the enemy has been in no better case. It is inevitable

that a service which is in a constant state of what we may call constructional flux should be subject to these periodic crises. As we have pointed out many times, there must be periods during which we hold the mastery of the air, and again others during which the positions are reversed and the ascendancy has passed to the enemy. It is not as though the aeroplane had reached anything approaching finality in its design. If that were the case, then the mastery of the air would as a natural consequence pass permanently to the Power possessed of the greater capacity for manufacture. As it is not so, that greater manufacturing capacity may quite conceivably operate to the temporary disadvantage of the country possessing it, since that country is obviously able to make wider plans for construction, with a consequent disability when new developments lead to modifications of design. We have seen how the pendulum swings first in our favour and then to the side of the enemy as new inventions and new designs come along, and we have also seen the effects of which we have spoken in the reluctance of our authorities to scrap long series of machines under construction when they have become obsolete. That seems to lie at the root of our own air service troubles, and to form the text of the questions which Mr. Pemberton Billing has developed such a fondness for addressing to the Under-Secretary for War. We are in complete sympathy with his efforts to secure greater efficiency, both of construction and administration, but we do most severely deprecate his references to "murder" and his personal attacks on Sir David Henderson, the one naturally arising out of the other. It is no part of our intention to embark upon a defence of an officer whose record of service to the country is fully sufficient and distinguished to render that entirely superfluous. Mr. Pemberton Billing would be much more likely to achieve something like a permanent effect for good if he would keep his questions within the bounds of decency and proper feeling. He certainly has a good case up to a point. We know that all is not well with the air service. The tale of losses at the Front, and the stories that filter through regarding the superiority of the best German machines to those we are in the main using is sufficient earnest of that, and he is only performing a public duty in drawing attention to our shortcomings and in pressing for better administration all round, but when he allows the appearance of personal animus to display itself, he discounts his case almost beyond measure.

"A Trade Union Scandal." Under this heading some decidedly acrimonious correspondence has been published in *The Times*, in the form of letters from Mr. Chas. Marston and the secretary of the Sheet Metal Workers' and Braziers' Union. The correspondence began with a letter from Mr. Marston, alleging that the Union, in the usual old way, has consistently declined to allow its labour to be diluted, and restricts output on scientific lines which prevent men earning what they could earn. The secretary of the Union counters it with what amounts to the lie direct, particularly in the reference to restriction of output. He says that "the output is not restricted on scientific principles. The men in most cases work to time limits, brought about in several instances at the request of the employers." That is direct enough, in all conscience.

Mr. Marston hits back hard in a reply to this and says, with reference to this point, that there was an agreement entered into in January, 1915, providing that the prices of piecework should be fixed by mutual agreement between the employer and the workmen performing the work. In spite of this very definite agreement, the Union has declined to work piecework at all in the motor and aeroplane branches. In other branches of the industry in which piecework is allowed by the Union a quick workman can do more than double what he will do on day work. Mr. Marston's commentary on this is, that the public can, therefore, form some idea of the restrictions in the motor and aeroplane industries. He adds: "The recruiting authorities should enquire into these qualifications (of the men). This sort of scandal would not occur if the Government would consult the manufacturers in regard to the framing of all rules."

It is absolutely astonishing, at this late stage of the war, to learn of such a state of affairs in a vital industry as is disclosed in Mr. Marston's communications to *The Times*. We are losing the valuable lives of gallant officers and men because of our inability to achieve a sufficient output of the best machines to ensure the permanent command of the air, and here is an instance of at least one trade union putting obstacles in the way of speeding up our new machines. To our way of thinking, these men are morally guilty of the deaths of many of those whose lives are being sacrificed in flying obsolete and inferior machines. Almost equally guilty are the responsible Government officials who have only to say how the thing shall be done, but who refrain from taking the necessary action. There ought to be no question at all of "day work" in any of the vital industries. Everyone with the smallest experience of works' management knows that the surest way to restrict output is to put hands on day work, and, equally, the surest way to accelerate production is to introduce the piecework system. It seems to us to be full time that the Ministry of Munitions made an Order forbidding any but piecework rates to be paid to skilled labour engaged in producing munitions or equipment. The thing might be carried even farther and a categorical warning given that any attempt to restrict output, in any way whatsoever, would land the offender or offenders in the trenches forthwith, and that without taking the slightest notice of any considerations of military age or disability. It is absolutely intolerable that at a time like this, when we are fighting for our existence as

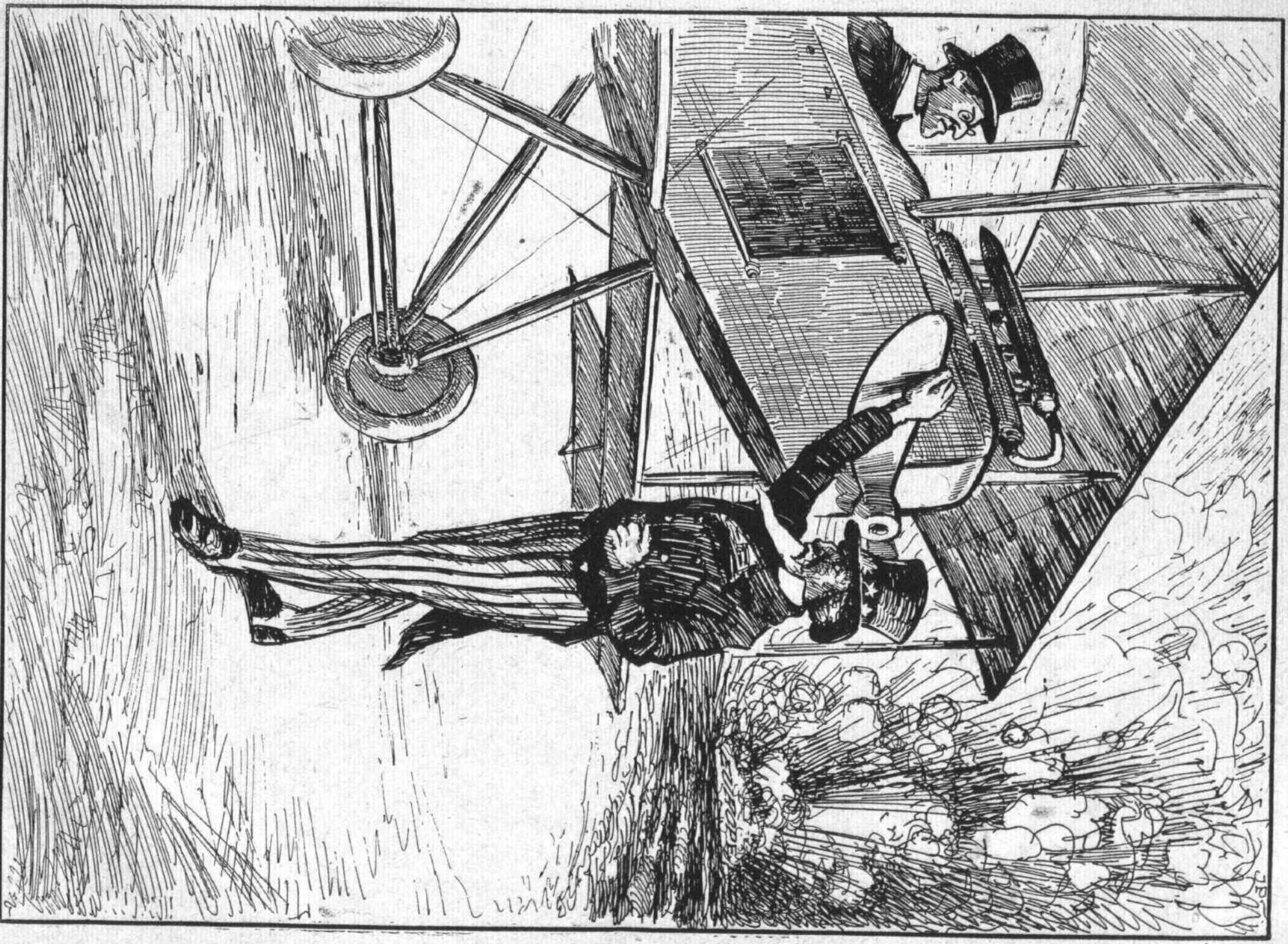
an Empire, people should be allowed to jeopardise the success of our arms by the exercise of the worst sort of trade union tricks. We have every sympathy with sane trades unionism, but when it comes to this sort of thing, then we have no use for the unions or their methods.

The Russian Revolution.

If ever there was a case of the plotter being hoist with his own petard, we see it in the recent upheaval in Russia. For years past Germany has been striving by every means in her power to gain ascendancy in the councils of the Russian governing class. Court and Government were honeycombed with German intrigue, until no man knew whether his neighbour were patriot or traitor. Ever since the outbreak of the war, Germany has done her best to bring about a revolution in the country, and at last she has succeeded in her design. But her very success has carried bitter defeat with it, for the revolution that has come about is the exact antithesis of the one designed by Germany, which was to have had the effect of detaching Russia from the Entente and, if not to actually range her on the side of the Central Powers, at least to make sure of a separate peace that would allow the brigands of Europe to concentrate all their resources against France, Italy and ourselves. What has actually happened is that patriotic Russia has revolted against the autocratic bureaucracy that would have sold her into bondage, and now stands out solid for the prosecution of the war to a bitter end, and with the stern resolve to have no more of the *régime* that has brought her so perilously near to disaster.

As we have said, the revolution is really one against a malign bureaucracy rather than against the Imperial house, and it will be well if other bureaucracies will take warning from the happenings of the past week. True, the Russian was a traitorous bureaucracy. That is why it fell *during* the war, instead of having its fate deferred until afterwards. but the warning is there all the same. Public opinion in all countries is undergoing tremendous changes as a result of the upheaval of civilisation through which we are passing at present and revolution is in the air. It is a contagious disease, too, and in the present state of public feeling all over the world there is no knowing where it will break out next. In some cases the revolution will be accomplished constitutionally, in others it will be accompanied by bloodshed, but revolutions there are bound to be before the world is many years older—unless the bureaucracies of Europe see wisdom in time and mend their ways.

By all the laws of probability, Germany herself ought to lead the way. It is a dangerous example she has set to her own people in fomenting revolution in Russia to see it turned against herself. All she has succeeded in doing is to afford her own people an object-lesson in how easy it is to get rid of a system and a Government that has ceased to carry the confidence of the people, even a people so docile and wedded to established institutions as the Russian. Dragooned and disciplined as the Germans are, it is impossible to doubt that the events in Russia have given them very serious food for reflection. They must realise by now that the Hohenzollerns have been by far more false to their trust than the Romanoffs. They have accomplished the ruin of the



When?

German Empire—nothing more nor less—and the people must realise that to the full by now. Will the German people make up their minds to act on the example given them? It is impossible to say—yet. But it is an interesting speculation, all the same.

The N.P.L. and the Industry.

In taking the chair at the lecture arranged by the Aeronautical Society, on "Airscrews" delivered by Mr. Fage, Mr. Grahame-White delivered himself of some very pertinent remarks in connection with the relations between the National Physical Laboratory and the aircraft industry. Remarking that the lecturer, by reason of his connection with the N.P.L. was at an advantage over his audience, the Chairman proceeded: "The plant of the Laboratory costs thousands of pounds to instal, and is altogether outside the reach of the average aircraft designer and constructor. Even if every constructor were financially powerful enough to instal such an expensive experimental plant it would be undesirable, for there would inevitably be a great waste of energy, owing to a large number of experiments going over the same ground several times, which could be obviated if one central scientific research laboratory were devoted to aeronautical experiments, open and accessible to all aircraft designers and constructors. It may be suggested that the N.P.L. adequately fills this rôle, but such has not generally been the experience of designers and constructors—more's the pity. It may be said that the industry does not contribute any financial support to the N.P.L.—that it is supported by and run for the benefit of the Government departments; but surely a *National* laboratory is, or should be, run for the benefit of the country, and hence to the advantage of the aircraft industry. Aeronautical research is, of course, only one branch of the important work carried out by the N.P.L., and I would most respectfully suggest that if the aeronautical branch is to be of any real value to British aircraft designers and constructors, the staff, plant and data should be more accessible to them. If these changes could be effected, the N.P.L. aeronautical section would, I am sure, if necessary receive adequate financial support from the Society of British Aircraft Constructors, whose members

would then be able to get any tests which they might require carried out. They would also be entitled to obtain any important data before it became obsolete, as has often been the case in the past. Failing any such arrangement, would it not be desirable for the Society of British Aircraft Constructors to establish, for the benefit of its members, a technical research laboratory devoted exclusively to aeronautical research and equipped with all the necessary plant which development might from time to time demand?"

In speaking thus, Mr. Grahame-White simply focussed the feeling that has become more and more accentuated with the lapse of time that the N.P.L. is an institution which is of very doubtful service to the private constructor, by reason of the inaccessibility of the data relating to its undoubtedly valuable work. Let us make it perfectly clear that the fault does not lie with the N.P.L. itself, but with other Government departments, which dam the stream of information at its source. The fault lies elsewhere than at Teddington, and must be sought in Whitehall itself. Even in these serious times, when we are striving to keep in front of the enemy in design and when every atom of data should be open to our designers, the least critical verdict than can be passed on the N.P.L. is that, as an institution, it is not particularly helpful to the industry, and that through no fault of its own. There seems to be a want of appreciation of the fact that we are all working to a common end—the defeat of the enemy—and that the more mutually helpful we are, the better will be the prospect of early victory. The point that a *National* institution ought to be national in its work as well as in name is a good one, but we fear that that sort of argument does not go a great way towards convincing the departmental mind. We agree entirely that the tests and data of the Aeronautical Department ought to be immediately available to the whole industry where they have any bearing on development, but we are not sanguine of receiving an affirmation of the view from official quarters. It is one of the scandals of our administrative methods that institutions, supported out of public funds, presumably for the public benefit, should be narrowed down in their scope so as to be of departmental use only.



A Government Committee on Light Alloys.

WITH the object of co-ordinating the work which is now being done in connection with the use of light alloys in the construction of aircraft and aircraft engines, the Advisory Committee for Aeronautics has appointed a Light Alloys Sub-Committee. The members are Mr. Henry Fowler, Superintendent of the Royal Aircraft Factory, chairman; Lieutenant-Commander C. F. Jenkin, R.N.V.R., and Professor F. C. Lea, representing the Air Board; and Captain H. P. Philpot, Mr. A. W. Johns, and Dr. W. Rosenhain, representing respectively the Aeronautical Inspection Department, the Director of Naval Construction, Admiralty, and the National Physical Laboratory; together with the chairman of the Advisory Committee for Aeronautics, *ex officio*.

The functions of this sub-committee will be to advise Government Departments on questions relating to light alloys, to institute research for the development and improvement of such alloys and the methods of working them, and to assist in the removal of difficulties which may arise in their production and use. The Sub-Committee will be in close touch with the experimental work on light alloys which is being carried out at the National Physical Laboratory, the Royal Aircraft Factory, the University of Birmingham, and elsewhere, and hopes to be able to give advice and assist-

ance to manufacturers undertaking the production of light alloys and to founders engaged in the manufacture of engine parts, cylinders, pistons, crank cases, &c. It trusts to have the co-operation of firms who have undertaken such work, and will be glad to receive suggestions and give any possible help in answer to enquiries. Communications should be addressed to the Secretary, Advisory Committee for Aeronautics, National Physical Laboratory, Teddington, Middlesex.

Aeroplanes from Basuto Chiefs.

THE Secretary of State for the Colonies made the following announcement on March 16th:—

"The High Commissioner for South Africa reports that the Paramount Chief of Basutoland has forwarded to him the sum of £40,000 as a gift from the Paramount Chief and the Basuto nation to the King for the purposes of the war. The gift has been warmly acknowledged on behalf of His Majesty, who has approved of the money being used for purchasing a number of aeroplanes."

A Further Gift from Siam.

THE British Minister in Siam has forwarded a further sum of £465 subscribed to the Siam British Subjects' Aeroplane Fund for the upkeep of two battleplanes, Siam No. 1 and Siam No. 2. The total sum thus subscribed in Siam is £4,965.

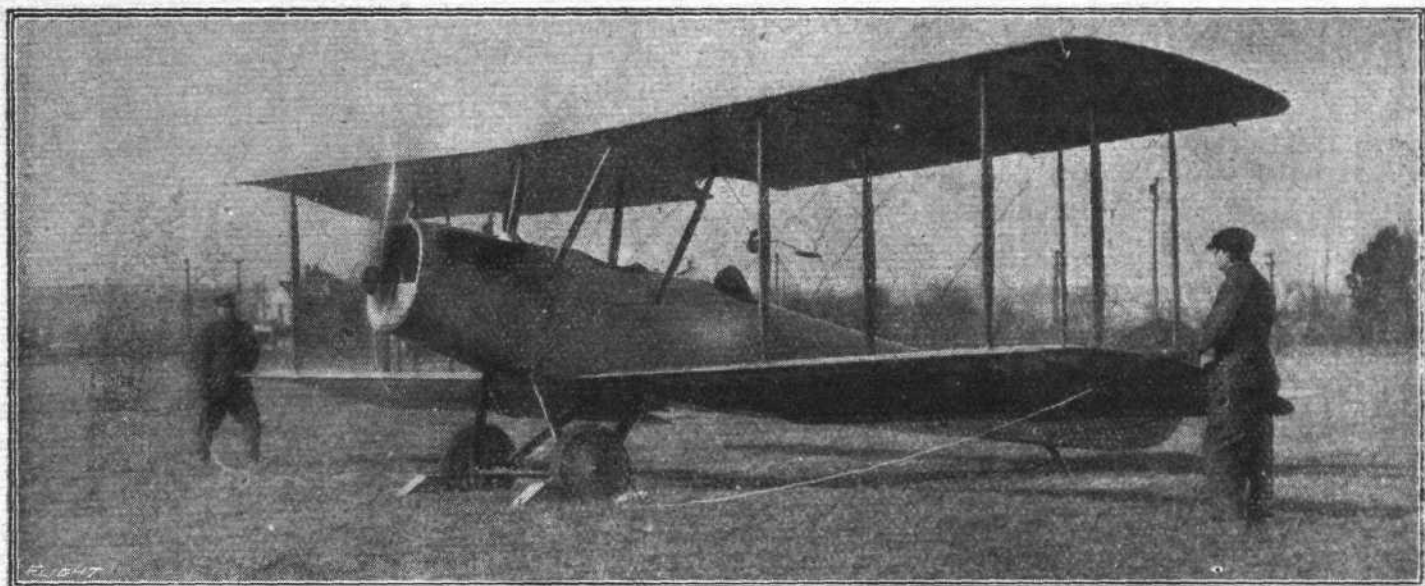
THE WRIGHT-MARTIN MODEL "V" RECONNAISSANCE BIPLANE.

THE Wright-Martin Model "V" is a two-seater tractor biplane of 150 horse-power, designed for long range military reconnaissance, with the observer's cockpit well forward of the entering edge of the lower wings.

The power plant consists of a Simplex Model A Hispano-Suiza eight-cylinder water-cooled engine

interposed. An oil radiator is located flush with the under cowl and connects with a separate oil tank of 4 gallons capacity in the rear of the engine compartment.

The wings are staggered and have a slight dihedral angle. Three sections comprise the upper plane, the two outer sections being attached to a central panel

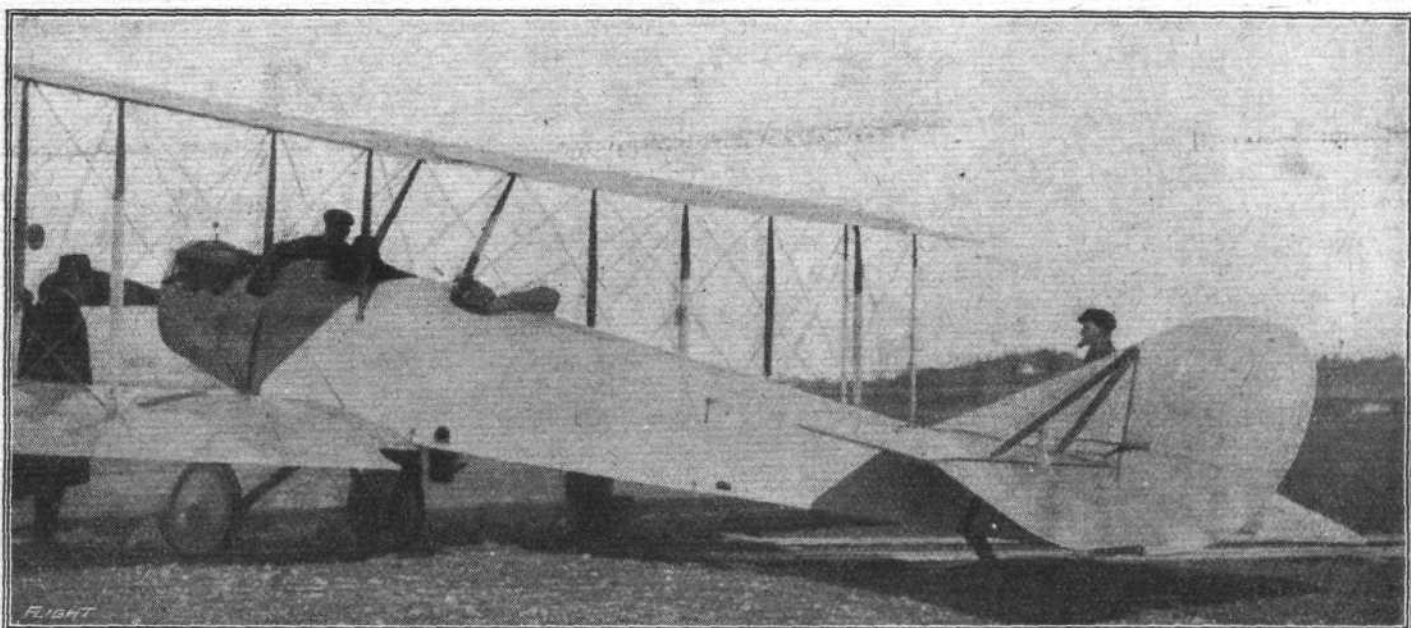


THE WRIGHT-MARTIN MODEL "V" TRACTOR BIPLANE.—Three-quarter front view.

(made under the Birkigt patent), driving direct a two-bladed tractor screw. The propeller is equipped with the French standard hub, keyed and locked to the tapered crankshaft extension.

As with the Model R, the motor unit is located in a demountable nose compartment, of tubular and pressed-steel construction, enclosed with hammered

supported above the fuselage by two pairs of struts. The lower wings are in two sections attached direct to the fuselage. The hinged wing attachments are locked together with nickel steel quick-detachable pins. The curve is the Vought 4, developed to meet the requirements of maximum efficiency, wide speed range and structural safety. A noteworthy charac-



THE WRIGHT-MARTIN MODEL "V" TRACTOR BIPLANE.—View from the rear.

sheet aluminum bonnet fitted with large doors and louvred ventilators. The fuselage entry is formed by the oval German silver cellular radiator located immediately back of the propeller. The radiator is supported by novel means directly on the pyramided motor mounting, with a vibration-absorbing medium

teristic is the minimum translation of the centre of pressure throughout the useful range of incidence angles.

The chord, 5 ft. 9½ ins., is the same for both planes, and a differential incidence setting is used. The curve permits of the employment of two very substantial

spruce I-section main spars and a third stringer spar of the semi-continuous built-up type, the latter disposed between the main beams to increase the wing strength, and serve as an aligning member for the ribs themselves. These latter are of the built-up type, bench-made to metal patterns to insure uniformity and interchangeability. Rib materials are spruce for battens and poplar for webs, the assembly carefully glued up and brass nailed. Wide box ribs are used at all panel points and light false nose ribs of spruce are employed between the main ribs. All ribs are re-inforced to strengthen them in longitudinal shear. Leading edges are of spruce, hollowed, while the trailing edges are of white ash. Wing tip bows are of bent ash, hollowed and maple-dowelled to the spars and nose pieces. The lower wings are fitted with wide rubber stripped contre-plaque flooring at the roots, and have comfortable hand-hold grips adjacent to the rear spars at the tips.

All the wood-work of the wings is given one coat of wood filler and two coats of waterproof varnish; metal parts are given three coats durable enamel, baked on. This treatment obtains throughout the machine. The wing covers are made from uncalendered Irish linen, sewed and laid diagonally. The fabric is secured to the ribs by sewing and tacking and re-inforced with suitable linen taping. The cloth is treated with five coats of Wright-Martin doping mixture, and finished with two coats of Glidden special flexible waterproof varnish.

In the *cellule*, the interplane struts are of solid spruce, streamlined and tapered and fitted with pressed steel socket ends. The fittings are stampings from chrome vanadium steel, with baked enamel finish. Turnbuckles are of the clevis-and-pin type, with nickel steel shanks and bronze barrels. All wires, struts and similar components are quickly detachable by removing nickel steel lock pins, and render assembly or replacement easy and very quick. Wires and turnbuckles are enamelled for preservation against weather. Roebling stranded cable is used, and all eyes have saddles, and are copper served and soldered. The lower wing trailing edges next the *fuselage* and the centre section are cut away to facilitate the pilot's view. Four large *ailerons* are hinged to the rear spars, having a semi-closed gap. Each *aileron* frame is of spruce and tubular steel, carefully reinforced, the covering and its treatment being the same as with the wings. Three hinges per *aileron* are employed and a very simple and direct control is used, top and bottom *ailerons* being connected by spruce struts.

The *fuselage* is of rectangular section, flat-sided, and fully enclosed, accommodating pilot and passenger in well-crowned and padded tandem cockpits—the pilot being placed in an advantageous position in the rear cockpit. A special feature is the detachable nose. This houses the motor and radiator, the fuel and oil tanks, equipment and supplies, and the live load being in well-arranged, compact, individual compartments in the main body. The fuel tanks are removed from proximity to the motor compartment to minimise fire risk, the service tank being located in the cowl aft of the front cockpit. The main tanks are placed longitudinally, and to the rear of the front seat on padded floor cradles. Fuel is supplied by pressure. An air-pump, integral with the motor, serves the system, except for starting. The cockpit rims are padded and leather-covered, while the cockpits are upholstered in leather.

The *fuselage* tapers aft of the wings to a vertical

tubular knife edge at the rear, which serves as an anchorage for the fin and rudder assembly. It is constructed, with the exception of the steel motor mounting, of ash and spruce *longerons*, struts and cross members, amply cross braced with Roebling's vanadium steel wire and Wright-Martin short-type turnbuckles. The fittings are substantial throughout, and, in the main, are steel stampings, embossed and die-formed from special steel. A substantial system of "follow-through" has been detailed into the *fuselage* design forward.

On the dashboard of the rear cockpit are neatly grouped the various flight and mechanical instruments. Transparent wind shields add to the comfort of pilot and passenger. Forward the *fuselage* is covered with sheet aluminium, whilst rearward linen fabric is employed, with provision for quick inspection of the truss members by means of a detachable deck. A large door renders the enclosed tail-skid mechanism get-at-able.

The chassis is of the two-wheeled type, and is designed to greatly minimise resistance. This component is readily demountable as a unit, or individual parts may be disassembled with a minimum of inconvenience and disturbance of adjacent members. Practically all the parts are removable through the agency of quick-detachable nickel steel lock pins of large diameter. The chassis is composed of two sets of ash V struts of streamline section, combined with a streamlined system of twin parallel steel cross tubes attached to the steel boxes at the apices of the Vs, and an improved wheel and axle assembly. The whole unit is cross-braced with heavy cable and corresponding turnbuckles and fittings. The chassis struts are attached to the *fuselage*, with suitable steel clip-and-pin fittings. The cross tubes, or horizontal compression members, are of large diameter, and are fitted with forged q.d. clevis ends, pinned and brazed in. This member supports, and with its sheet aluminium stream line houses, the axle, which is hinged at the centre. The cross tube and axle hinge load is carried by two diagonal steel cables running up to the *fuselage* forward attachment plates. The axles are nickel steel tubing, specially heat-treated, and the outside diameter is large with a substantial wall thickness suitably reinforced at points of greatest load.

Either axle member can be withdrawn through its shock absorber spool, without affecting the adjustment of the shock absorbing mechanism. The axle hinge pins are quickly get-at-able by removing a small plate on the housing. The axles and rubber shock absorber retainers operate in a detachable enclosed guide of substantial construction and move vertically whilst the machine is taxi-ing. This design eliminates all binding and the necessity of troublesome radius rod members. The shock absorbers are cotton encased rubber cord of large diameter, approximately 10 yards being used for each axle, and the strand is laced over and retained by belled steel spools of demountable construction. The wheels made in the Wright-Martin factory are of very sturdy construction, yet reasonably light. They are shod with 26-in. by 4-in. Goodyear double tube tyres, and have specially-designed hubs, with pressed steel flanges shrunk on, the spoke rows being more than 6 ins. apart. The spokes are heavy gauge, of best quality steel, 36 being used to each wheel, tangent laced.

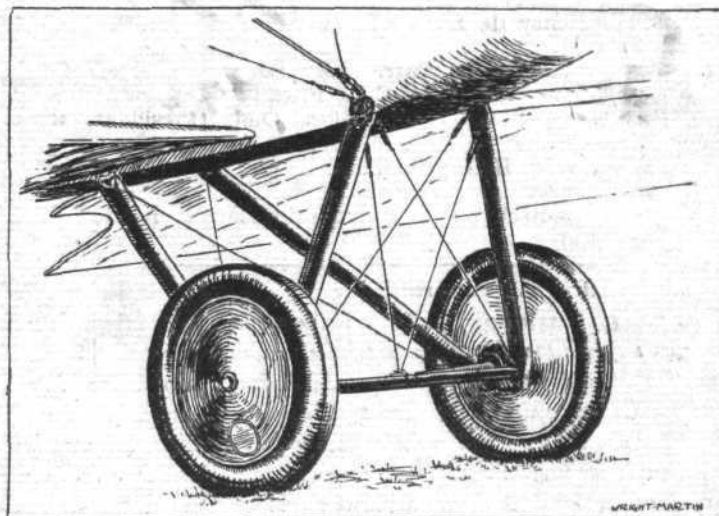
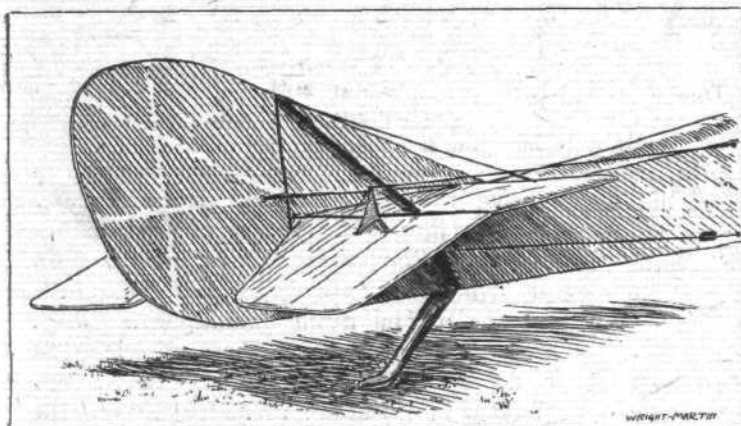
Bronze bushings are fitted and the hubs are self-lubricating, with grease capacity for a full season's use. Hexagonal bronze hub caps screwed on and

pinned are used to hold the wheels in position. The air valve is accessible through a small circular aluminium door in the casing, which latter is of the same material as the wing covers, similarly doped and finished. The wheel tread is 5 ft. 3.5 ins., or slightly more than one-seventh the span of the lower wing. The weight of the complete chassis, including disc wheels and shock absorbers, is only 86 lbs.

A tail skid of low head resistance protects the rear of the machine. This is of substantial ash construction, operating semi-universally against the tension of the rubber shock absorber coils, enclosed within the *fuselage*. The skid floats on a reinforced tubular steel cross strut, and is aligned by heavy helical springs concentric with the strut. A large aluminium door in the side of the *fuselage* allows easy inspection and adjustment of the skid mechanism, and this construction has reduced the resistance of this component to a minimum. The skid is shod with a bronze shoe, which is secured in place by bolts and readily replaced when worn out. There are *empennage* brace anchorages in connection with the skid or stern post.

The *empennage* consists of a moderately double cambered fixed horizontal stabiliser of high aspect ratio, to which are attached the dual elevators, on each side of the unbalanced rudder, forward of

brazed. No welding operations whatever are employed in making up the *empennage* frames. All ribs and spars are attached to the tubular frame members by sheet socketing clips tangent brazed in place. The internal cross bracing consists principally of the wire and fitting system employed in the main planes, though four light sectioned spruce diagonals are used in addition. The stabiliser rib structure is constructed over an I-section spruce spar of large section located laterally 1 ft. 2 ins. back from the entering edge. By the use of this substantial spar, all external bracing to the forward part of the horizontal stabiliser has been eliminated, and the necessary depth of section is provided for the double-cambered profile. Elevator and rudder hinge fittings are steel stampings pinned and brazed in place. These are provided with means for lubrication, and the surfaces are unhinged by withdrawing quick-detachable pins. Quarter-inch nickel steel bolts and steel jaw clips attach, respectively, the stabiliser front spar and entering edge to the *fuselage*. The rear spar is secured by two $\frac{1}{8}$ -in. bolts, and the whole assembly locked by the fin extension which telescopes into the *fuselage* tubular stern post, there secured by a lanyarded taper pin.



The tail components of the Wright-Martin model "V" tractor biplane, and on the right, sketch of the chassis of the Wright-Martin model "V" tractor biplane.

which is the fixed vertical fin. The design of the *empennage* enables the units to be very quickly assembled, the chief novelty being in the system of inter-locking the various parts and the minimised external bracing required to adequately support the surfaces to the *fuselage* structure. Only four streamline steel tubes are required, two from the fin downward to the rear spar of the stabiliser, and two diagonally forward from the stabiliser to the *fuselage* lower *longerons*. These braces, like the struts and other components noted above, are fitted with approved clevis ends and are locked in place with nickel steel pins. All elevator and rudder ribs are carefully sparred, and these surfaces provided with a light spruce spar disposed 10 ins. forward of the trailing edge to aid in equalising the load on the ribs themselves. Bracing wires anchored on or in proximity to the trailing edge are not used, and the control arms are designed to eliminate brace wiring as much as possible. The frames of the tail components are made entirely of cold-drawn seamless steel tubing of various sizes and thicknesses, and in some cases of special section, depending on the function of the particular part. Steel members are joined by special forged or drawn steel fittings pinned in place and then

The whole system is then interbraced by the streamlined tubing outside stays.

The Dep. system of control is used, consisting of the wheel column, and ash and steel foot rudder bar. The rudder bar is substantially mounted on a steel pedestal secured to the flooring and *fuselage* truss. The 16-in. corrugated control wheel is mahogany rimmed with an aluminium spider and chain sprockets of bronze, all mounted on a steel column.

The control surfaces are operated through doubled control cables, changes in direction being taken care of by substantial chains passing over pressed steel pulleys of novel design. An enclosed rock shaft is disposed in the elevator control mechanism back of the pilot's seat to eliminate any lost motion and the usual crossing and slacking of these control wires, and all adjustments can be made from the cockpit.

The general characteristics of Model "V" machine are:—Span, 39 ft. 8.5 ins.; chord, 5 ft. 9.5 ins.; gap, 5 ft. 7 ins.; overall length, 27 ft. 2 ins.; overall height, 9 ft. 5.5 ins.; stagger, 1 ft.; dihedral angle, 1° 15'; supporting surface, 430 sq. ft.; loading, 5.66 lbs./sq. ft. (16.86 lbs./b.h.p.); weight empty, 1,725 lbs.; useful load, 905 lbs. (including fuel and oil for 6 hours' flight).

ROYAL AERO CLUB OF THE U.K.

OFFICIAL NOTICES TO MEMBERS.

ANNUAL GENERAL MEETING.

THE Annual General Meeting of the Members of the Club was held on Tuesday, the 20th inst., at 6 o'clock, when there were about forty Members present.

The Chairman, the Duke of Atholl, said that he regretted he had been so long away from the Club. He was very pleased to find the Club so comfortably housed in its new quarters, which he thought were quite suitable, at any rate for the present. He congratulated the Club on having left the old premises, and wished to thank Professor Huntington for all he had done.

Election of Vice-President and Council.—On the motion of the Chairman, seconded by Mr. Gavin W. Ralston, the Vice-President and Council for the ensuing year were unanimously elected as follows:—

Vice-President.

The Rt. Hon. Lord Northcliffe.

Council.

S.A.I. Prince Roland Bonaparte (President F.A.I.).

The Rt. Hon. The Earl of Hardwicke.

The Rt. Hon. The Earl of Lonsdale.

The Rt. Hon. Lord Howard de Walden.

The Rt. Hon. Lord Kinnaird, F.R.G.S.

The Rt. Hon. Lord Montagu of Beaulieu.

Admiral of the Fleet the Rt. Hon. Sir Edward Seymour, P.C., G.C.B., O.M., G.C.V.O.

Admiral the Hon. Sir Edmund Fremantle, G.C.B., C.M.G.
Count Henry de La Vaulx (Vice-President Aero Club de France).

Sir David Salomons, Bart.

Sir Norman Lockyer, K.C.B., F.R.S.

Professor Sir William Crookes, O.M. (President, Royal Society).

The Rt. Rev. Bishop Welldon.

Martin Dale.

Henry Deutsch de la Meurthe (President, Aero Club de France).

Committee Ballot.—The result of the ballot for the nine vacancies on the Committee was declared as follows:—

Brig.-Gen. W. S. Brancker, R.F.A.

Flight-Commander John D. Dunville, R.N.

Wing-Commander Spenser D. A. Grey, R.N., D.S.O.

Col. Sir Capel Holden, K.C.B., F.R.S.

Wing-Commander A. M. Longmore, R.N.

Col. E. M. Maitland.

Squadron-Commander F. K. McClean, R.N.

Lord Northcliffe.

Wing-Commander Alec Ogilvie, R.N.

Council.—On the motion of the Chairman, Professor A. K. Huntington was unanimously elected a Member of the Council.

Professor Huntington thanked the Members for the honour.

On the motion of Mr. Gavin W. Ralston a unanimous vote of thanks was passed to the Chairman.

THE FLYING SERVICES FUND

administered by

THE ROYAL AERO CLUB.

THE Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 3, Clifford Street, New Bond Street, London, W.

Subscriptions.

Total subscriptions received to Mar. 20th, 1917 11,209 16 4

B. STEVENSON, Assistant Secretary.

3, Clifford Street, New Bond Street, W.

Light Alloys in Aircraft.

The National Physical Laboratory announces that the committee has appointed a light alloys sub-committee, with a view to the co-ordination of the work which is now being done in connection with the use of light alloys in the construction of aircraft and aircraft engines. The functions of this sub-committee will be to advise Government departments on questions relating to light alloys, to institute research for the development and improvement of such alloys and of the methods of working, and to assist in the removal of difficulties which may arise in practice in their production and use. The sub-committee will be in close touch with the experimental work on light alloys, and hope to be able to give advice and assistance to manufacturers undertaking the production of light alloys, and to founders engaged in the manufacture of engine parts, cylinders, pistons, crank cases, &c. They trust to have the co-operation of firms who have undertaken such work, and will be glad to receive suggestions and to give any help that may be possible in answer to enquiries.

Fatal Accidents.

AN inquest was held at Lincoln on March 12th, relative to the death of 2nd Lieut. C. Smith, R.F.C. According to the evidence, after completing one circuit at 1,000 ft., the deceased switched off to come down, but apparently forgot to put on his right rudder. The machine spun to the left, and although the pilot managed to right it, it immediately went into another spin, and then seemed to be out of control. At about 40 ft. it suddenly nose-dived to the ground. A verdict of "Accidental Death" was returned.

A verdict of "Accidental Death" was returned on March 15th, at an inquest on the body of Lieut. Leonard Murray, Lancashire Fusiliers, attached R.F.C. Lieut. Murray was flying on March 13th, and after his first two flights alone he stepped from his machine, and, in so doing, was struck on the head by the still revolving propeller. He died while he was being taken to the hospital.

This is a move in the right direction. As we pointed out in the first of a series of articles on "Metal in Aeroplane Construction," in our issue of February 22nd, while the improvement in the aerodynamical qualities of the flying machine has been great during recent years, there has not been a corresponding advance in the methods of construction employed. That is in no small measure due to the fact that enough attention has not been given to the scientific evolution of light metal alloys, which has had the result of tying us to the continued employment of wood in aircraft construction. As a rule, the private constructor has neither the plant nor the time to spend on the evolution of better materials than those immediately at his disposal, and must perforce do the best he can with what is to hand.

Obviously, this is a case where such an institution as the N.P.L. can do further invaluable work, and we welcome the departure which is announced in the communication from which we have quoted.

"Death from Misadventure" was the verdict at the inquest on March 16th, on Lieut. E. R. Mackey and 2nd Lieut. G. S. Raine, of the R.F.C., who were killed while flying over Hertfordshire. Their machine came into collision with another at a height of 800 ft. The second machine, after being twice righted, came into contact with an oak tree and fell, the pilot, Lieut. W. G. Potts, being injured.

Two R.F.C. officers met with a fatal accident on the South Coast on March 18th. Late in the afternoon 2nd Lieuts. W. S. Morrison and J. J. E. Gray ascended in a biplane. The machine was seen to be in difficulties. It made a nose-dive to earth, one of the officers being thrown out. The other came down with it. Both were killed instantly.

At an inquest on March 19th, on Lieut. D. D. Fowler, R.F.C., the jury returned a verdict of "Accidental Death."

THE ROLL OF HONOUR.

Reported by the Admiralty:—

Accidentally Killed.

Flight Sub-Lieut. Ronald V. Knight, R.N.

Accidentally Drowned.

Flight Sub-Lieut. Rowland Birks, R.N.

F 4331 1st Grade Air-Mech. C. D. Boyland, R.N.A.S.

J 29316 2nd Grade Air-Mech. A. E. Goode, R.N.A.S.

Reported by the War Office:—

Killed.

2nd Lieut. V. A. Berridge, Bedfords, attd. R.F.C.

2nd Lieut. G. M. G. Bibby, R.F.C.

2nd Lieut. H. G. C. Bowden, R.F.C.

Lieut. C. J. O. Brichta, Can. Mounted R., attd. R.F.C.

2nd Lieut. W. S. Gardner, R.F.A., attd. R.F.C.

2nd Lieut. G. W. B. Hampton, Suffolk and R.F.C.

Lieut. W. F. W. Hills, R.F.C.

2nd Lieut. G. C. Hoskins, R.F.C.

Capt. the Hon. E. F. P. Lubbock, M.C., F.R.C.

2nd Lieut. A. J. McWha, R.F.C.

Lieut. C. W. Short, M.C., Ind. A. Res. of Off., attd. R.F.C.

Capt. F. J. Simpson, Can. M.R., attd. R.F.C.

2nd Lieut. D. B. Stevenson, Duke of Cornwall's L.I., attd. R.F.C.

2nd Lieut. J. Thompson, R.F.C.

31384 2nd Air-Mech. A. T. Chalmers, R.F.C.

17691 Acting-Corpl. E. De Comeroy, R.F.C.

14417 2nd Air-Mech. W. Parkinson, R.F.C.

32758 2nd Air-Mech. R. Ward, R.F.C.

Died of Wounds.

2nd Lieut. D. E. Greenhow, R.F.C.

2nd Lieut. G. R. F. Waner, R.E., attd. R.F.C.

41410 2nd Air-Mech. G. Clutterbuck, R.F.C.

740 Sergt. R. J. C. Tansley, R.F.C.

Died.

45144 2nd Air-Mech. G. F. Sharp, R.F.C.

Previously reported Missing, now reported Killed.

Lieut. T. M. Bennet, M.C., R. Irish R., attd. R.F.C.

Lieut. T. C. H. Lucas, Suffolk, attd. R.F.C.

Previously reported Wounded, now reported**Died of Wounds.**

Lieut. G. K. Simpson, R.F.C.

Wounded.

2nd Lieut. N. J. Brehner, Lincolns, attd. R.F.C.

2nd Lieut. O. G. S. Crawford, R.F.C.

2nd Lieut. L. C. Davies, M.C., Cam. (Sco. R.) and R.F.C.

2nd Lieut. S. McK. Fraser, Highland L.I., attd. R.F.C.

Capt. F. R. Hardie, Hussars, attd. R.F.C.

2nd Lieut. G. H. Harrison, Middlesex and R.F.C.

2nd Lieut. G. Howe, R.F.C.

Lieut. C. R. Knight, Queen's (R.W. Surrey), attd. R.F.C.

2nd Lieut. J. E. Lewis, R.F.C.

Lieut. J. W. Lockhart, R.F.C.

Lieut. R. Mayberry, R. Scots F., attd. R.F.C.

2nd Lieut. R. E. Neve, R.F.C.

Lieut. C. E. M. Pickthorn, A.S.C., attd. R.F.C.

2nd Lieut. A. C. Randall, R.F.C.

Lieut. A. R. Rattray, R. Ind. Mar., attd. R.F.C.

Capt. J. M. Robb, Northumberland F. and R.F.C.

2nd Lieut. P. J. Roe, Leinster, attd. R.F.C.

2nd Lieut. A. E. Turner, M.C., R. Warwicks, attd. R.F.C.

Lieut. W. H. A. Whitworth, M.C., Dorset and R.F.C.

2nd Lieut. W. A. G. Young, R.F.C.

15094 1st Air-Mech. W. Davies, R.F.C.

21983 2nd Air-Mech. A. J. Dunn, R.F.C.

8996 Sergt. W. R. Hemmings, R.F.C.

30641 2nd Air-Mech. N. Johnson, R.F.C.

26812 2nd Air-Mech. H. S. Skelf, R.F.C.

5528 Sergt. W. Swingle, R.F.C.

14079 2nd Air-Mech. A. Underwood, R.F.C.

Previously reported Prisoner of War, now reported Wounded and Prisoner of War.

Lieut. A. W. Brown, Manchester, attd. R.F.C.

Missing.

Capt. W. S. R. Bloomfield, R.F.C.

Sec. Lieut. F. C. Coops, King's (Liverpool), attd. R.F.C.

Major E. P. Graves, R.F.A., attd. R.F.C.

2nd Lieut. G. F. Haseler, R.F.C.

2nd Lieut. H. M. Headley, R.F.A., attd. R.F.C.

2nd Lieut. F. E. Hills, R.G.A., and R.F.C.

2nd Lieut. W. B. Hills, Hampshire and R.F.C.

2nd Lieut. A. Holden, Yorkshire, attd. R.F.C.

2nd Lieut. P. S. Joyce, R.F.C.

2nd Lieut. V. O. Lonsdale, R.F.A., attd. R.F.C.

2nd Lieut. M. J. G. Mare-Montebault, Yeo. and R.F.C.

2nd Lieut. A. J. Pearson, M.C., R.F.C.

Lieut. S. J. Pepler, Can. Inf., attd. R.F.C.

2nd Lieut. A. G. Ryall, Durham L.I., attd. R.F.C.

2nd Lieut. J. Shepard, R. Warwicks., attd. R.F.C.

2nd Lieut. C. A. R. Shum, R.F.C.

2nd Lieut. J. Smyth, R.F.C.

Capt. J. D. Stuart, Can. Pioneers, attd. R.F.C.

2nd Lieut. G. M. Underwood, R.F.C.

2nd Lieut. A. E. Watts, R.F.C.

Lieut. A. D. Whitehead, R. Warwicks., attd. T.F.C.

Previously reported Missing, now reported**Prisoner of War in German hands.**

2nd Lieut. F. A. Mann, Suffolk, attd. R.F.C.

Prisoners of War in Turkish hands.

Lieut. E. A. Floyer, Ind. A. Res. of Off., attd. R.F.C.

2nd Lieut. C. V. Palmer, Norfolk, attd. R.F.C.

Correction:**Killed.**

2nd Lieut. B. W. Hill, R.F.C., should read Lieut. Hill.

**Honours for the R.F.C.**

A SUPPLEMENT to the *London Gazette* issued on March 18th announced that His Majesty the King has been graciously pleased to approve of the undermentioned honours and rewards for distinguished service in the field, in Mesopotamia, with effect from March 10th, 1917, inclusive:—

To be Brevet-Major.

Capt. (Temp. Lt.-Col.) J. E. TENNANT, M.C., Scots Guards and R.F.C.

D.S.O.

Capt. (Temp. Major) H. DE HAVILLAND, R.F.C., S.R.

Military Cross.

Lt. J. R. BURNS, Scot. Rifles and R.F.C.

Sir Douglas Haig and the R.N.A.S.

THE Secretary of the Admiralty issued the following announcement on March 17th:—

"Field-Marshal Sir Douglas Haig, Commander-in-Chief, British Armies in France, has expressed his appreciation of the fine work and good services rendered by the squadron of the Royal Naval Air Service (No. 8) attached to his Armies.

"He states that this squadron has done much fighting, and that pilots have shown great enterprise and dash, and have always acquitted themselves admirably.

"Numerous offensive patrols have been carried out by the squadron over the enemy's lines, and it has to its credit

14 hostile aircraft certainly destroyed and 13 driven down, the larger part of which must have been wrecked."

Legion of Honour for American Pilot.

THE Cross of the Legion of Honour has been conferred on Adjutant Raoul Lufbery, a pilot of the 120th Aerial Squadron, who enlisted under the French colours for the duration of war. Up to December 27th, 1916, he had brought down six enemy aeroplanes, and has been awarded the Military Medal.

German Pilot Killed by Dutch Soldiers.

THE *Handelsblad* reports that, on March 13th, a German aeroplane, while flying over Sluis, was fired at by Dutch troops, who were drilling near the Terhofstede fortifications. The German airman, who was seen to be wounded, landed in Dutch territory, but had sufficient strength to restart his machine and descend again 300 yards beyond the frontier demarcation wire in Belgian territory. German troops hastened to the assistance of the wounded airman, who was last seen being carried away by a Red Cross detachment.

According to later information received by the *Handelsblad*, the pilot was dead when picked up at Knocke.

A German Claim.

THE *communiqué* issued from Berlin on March 19th, regarding the destroyer fighting, commences with the following:—

"One of our naval aeroplanes on Saturday afternoon dropped bombs on the gasworks at Dover."

AIRISMS FROM THE FOUR WINDS

WE do not notice any reference in the German report of their most recent Zeppelin visit to the Kentish Coast, to the interruption to all-night motor ploughing in the district, which their advent caused. What a chance they have missed to couple up the air and submarine campaign, as working in combination, to starve into subjection the inhabitants of these isles. It so happened that a motor plough was at work when one of the pirates passed over, and, no doubt, the brilliant acetylene light attracted their attention as a good target, as they dropped a bomb harmlessly on the land near by.

MR. ERNEST CLAREMONT, presiding at the annual meeting of Rolls-Royce, Ltd., last week at Derby, said he thought he was not disclosing any secrets in saying that the company were manufacturing engines for aeroplanes.

THE Zeppelin visits will have achieved at least one good work. They have been the means of bringing enjoyment to the very drab lives of the inmates of the City of London Lunatic Asylum, near Dartford. According to Dr. Steen, the Medical Superintendent of this institution, they were simply delighted with their views, upon the occasion of the various raids, of the descent of the three airships in flames. Otherwise the noise of dropping bombs and the guns and the shriek of the shells had very little effect on the hospital population, many of whom slept peacefully throughout the whole series of incidents.

Six thousand feet with a broken wing is not an experience that one would particularly wish to go through, and a pilot might safely lay off for a week or two, after getting rid of such a nightmare, without risk of having any reference made to

the temperature of his lower extremities. Yet Mr. Clifford B. Prodger, while admitting that the sensations during the 15 minutes or so that it took to get down were not such as he would like to have repeated, was out and flying as well as ever on the following day. It all came about in this way: Mr. Prodger was testing a machine "somewhere" in England, when, at a height of 6,000 ft., he heard an awful crash, and on looking up, discovered that the leading edge of his upper right-hand wing had broken, the pressure of the air tearing the upper covering off the top of the wing. The thin lath which formed the leading edge blew back along with the fabric, and got wedged between the rear spar and the *aileron*. For about 2,000 ft. the machine spun downwards rapidly. Then Mr. Prodger made up his mind that something had to be done or a crash was inevitable. By standing up in his seat, and steadying the "joy stick" (precious little joy about it just then, we fancy), he could, by reaching out, just touch the end of the broken leading edge. After a few moments of pulling and wagging the control lever, he managed to shift the lath so that his *ailerons* worked once more. By this time the fabric on the under surface of the wing was bulging "like a balloon," to use Prodger's own expression, and every moment he expected it to pull through the wing. By coming down in a series of left-hand spirals, keeping the injured wing slightly upwards, he managed, after what must have been some anxious moments, to land safely in the aerodrome. On examining the fabric, it was found that every trace of dope had been whipped off, leaving only the bare shredded fabric. It was evidently Prodger's lucky day.

UNCURBED and overstrung nature will assert itself occasionally in this very material world of ours, especially in such times as we are passing through in this year of Our Lord, 1917. And, perhaps, an apposite example may, therefore, be recorded in a description given when preaching last week, by the Rev. F. H. Gillingham. The occasion was a Zeppelin raid, when people rushed out of their houses, fell on their knees, and asked a curate to pray for them. When the Zeppelin began to fall, a mass of flames, they were up on their feet, shouting "Tipperary" and "Rule Britannia"—without a single thought of God. After all, it may only have been their crude method of expressing thankfulness for the granting of their desires.

AVIATION should form an important section in the National War Museum, which has been sanctioned by the Government, Sir Alfred Mond, Chief Commissioner of Works, is appointing a strong Foundation Committee, which will include representatives of the Admiralty, War Office, Ministry of Munitions, Literature, Science and Art. No building has yet been chosen, in fact, the site is not likely to be settled for some time, perhaps not until after the war is over. The object is to get a complete collection of the various arms and war appliances used by the Allies and the enemy, as well as relics of all sorts. The Ministry of Munitions already have a museum of British weapons of war, which will form a nucleus for the new museum.

THE official reporter of the House of Commons must have to solve some pretty knotty problems as to what hon. members say occasionally, and so he may be excused for transcribing Mr. Pemberton Billing's reference to streamlined wire as string-lined wire.

MR. PEMBERTON BILLING's exertions are not confined to bucking up the Air Services, apparently. He appears to be jogging up Father Time. Speaking in the House of Commons on March 15th, he said "and here in April, 1917."

Who said cunning traps? Leave that to our pilots and the Staff at the Front. The manner in which our Flying Forces are keeping in touch with the Germans in their retreat must, indeed, be enough to make the Huns strafe the R.F.C. with every atom of energy they may have left after they have got clear of our advancing Army. It's giving the enemy plenty to think about besides getting out of the danger zone.

SIR EDWARD MORRIS, Premier of New Foundland, last week described the conquest of the air in this war as worthy to rank in advance of any one of the seven wonders of the world.



Mrs. Joan Whipple, widow of Capt. H. C. Whipple, whose engagement is announced to Capt. W. L. Robinson, V.C., the pilot who brought down the Cuffley Zeppelin.

THE art of manufacturing "antique" furniture is reputed to be able to claim top place in the realms of "faking." It looks though as if the concoction for Hun political purposes of fictitious blood-curdling Zeppelin raids were likely to run the antique business to a very close finish, judging by the little plot which was disclosed the other day at the Thames Police Court, when John Robertshaw, an American citizen, and a fireman on the steamship "O. A. Kaudson," was charged under the Defence of the Realm Act with having in his possession for transmission or conveyance, otherwise than through the post, a letter without legal authority.

Robertshaw, it appears, arrived on Sunday in a Norwegian ship laden with grain, for Spain. An officer of His Majesty's Customs questioned him, when he produced the letter, and said he was going to post it when he arrived in Spain. The contents of the letter contained falsehoods and gross exaggerations, and referred to Zeppelin raids that had never taken place.

In the ordinary course the next stage would have been its despatch to Germany from an "Eye-witness," and, as the magistrate remarked, a paper like the *Cologne Gazette* would have been prepared to have given a lot of money for its possession. Three months in the second division will keep this "American citizen" out of harm's way for that period anyway.

"LOOPING the loop sideways" has been discovered by the daily Press. But it's a bit late, just the same. Ask some of them out at the Front what they think of it as a diversion to trench monotony—in the past.

It's a curious story that comes from the *Dagblad*, Christiania, regarding Lieut. Tryggve Gran, who will be remembered by his aeroplane flight over the North Sea some little time ago. Lieut. Gran has been, it is stated, ordered to resign his commission in the Norwegian Flying Corps for having appeared in uniform in a foreign country, it being added that he will probably become a naturalised British subject and join the British Flying Corps.

A propos Mr. Justice Sankey's decision in the King's Bench Division on Monday, *re* the ordinary Lloyd's Insurance Policy, with the usual clause as to non-liability for "loss caused by insurrection, riots, civil commotion, or military or usurped power," it would appear to be a quaint idea that any ordinary sane person should ever have thought the policy would cover damage from dropped Zeppelin bombs. Else, where does the necessity for national aircraft risks insurance come in? But there, we suppose, the lawyers *must* live somehow, and a nice fat disagreement like this carries very much big war rations with it. Personally, we recommend as cheaper for the non-legal citizen, the taking out of a Government insurance policy, especially now the cost is at 50 per cent. discount.

WE have many times asked our readers to help us to conserve printing paper, by placing firm orders for "FLIGHT" with some regular newsagent, or direct from this office. We take this opportunity of thanking the many readers who have done their bit in this direction, and we would now, by way of a further convincing argument to the remaining few stragglers, point out they will also be helping to make less imperative the struggle for economy in paper, which appears to be one great outstanding fact at present of Governmental Departments. By way of example of the shortage of paper in this direction, we have the testimony of Mr. Weber at the Shoreditch Tribunal, who announced one morning last week that he had just received an order from a Government Department amounting to 22s., and the forms used, which had to be filled up, weighed 18 oz. It is difficult to picture the state of mind of officials if further economy has to be organised.

GETTING-on-with-the-war examples. When Benjamin Barber, 23, a clerk, was charged on Monday, at Stratford, with being an absentee, he was not long in securing the sympathy of the Bench. As Mr. Caradoc Rees, M.P., who appeared for Barber, said: "If anyone has tried to get into the Army, it is this man." It appeared that on October 25th, 1915, Barber presented himself at Whitehall, and, being blind in one eye, was told to go to the Royal Flying Corps as an officer's servant. He went, and was told that references would be required. He got these, and was sent to Farnborough, where, after three days, an officer told him that the doctors at Whitehall were passing everybody for the Army, whether they were fit or not.

Barber was examined by the medical officer, and as his chest, lungs, and eyesight were affected, he was ordered to go to the commanding officer. The latter, telling him he was of no use to the Army, gave him his discharge, which read, "Discharged in consequence of not being finally approved, after serving five days with the colours."

On November 9th, Barber enlisted in the 2nd County of London Yeomanry, but was rejected, and six days later tried to join the Queen's Westminsters, being again rejected. Next endeavouring to join the City of London Yeomanry Roughriders, he was once more rejected, and then became enrolled in the R.N.A.S. anti-aircraft section, but had never been called up.

The Chairman: Do the military admit the facts as stated? Captain Sanford: Yes, but my point is that he was not discharged from the Army, because he was not "finally approved" for the Flying Corps. It does not debar him from being finally approved for some other regiment.

"Words weren't ekal to't," and so, without any comment, the chairman ordered Barber's discharge.

The "Captain" of the Military representative must surely cloak the body of a barrister in ordinary life and times. It is only one of many similar stories, and yet there is wonder that the right and needed men are not more rapidly combed out and raked in. It's War that matters, not Law.

TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT's" precursor and sister Journal) of March, 1907. "FLIGHT" was founded in 1908.

THE PISCIOF GLIDER.

M. A. De Pischof is an experimenter who has to be reckoned amongst those who have been doing good work in a quiet and unobtrusive manner. He has been experimenting with the sustaining power of various surfaces, and finds that an aerocurve, with an edge thickened forward and of somewhat sinuous outline, provides considerably more sustaining power than aerocurves as hitherto usually constructed. He has made a gliding machine in general outline somewhat similar to the Wright machine, but with the lower aerocurve a good deal shorter than the upper one on these principles, and has satisfied himself, by a series of glides, that flight can be effected at a much more moderate speed than is usually thought.

THE DELAGRANGE GETS OFF THE GROUND AGAIN.

The Delagrange aeroplane had a regular field day on March 16th on what we may now almost term the classical practice ground at Bagatelle. It is true it did not perform a very sensational flight, but it got off the ground for a good deal further than last time it tried, and did not dislocate its neck as on that occasion. Experienced aeronauts present considered the jumps it made were quite as good as M. Santos Dumont's first attempts, though, of course, whether this proves that the Delagrange machine will be ultimately as successful as his "Bird of Prey" only the future can show.



The formal presentation of a challenge cup given by Mrs. J. B. Manio for annual competition among the boys of St. John's School, Ealing, to encourage the study of aeronautics. Mrs. Manio is seen in the centre of the group, while to the left are Lady Tuck and Lieut. Tuck, M.C., R.F.C.; and, on the right, Mr. E. J. Gollidge, the headmaster of the school, and Mrs. Gollidge. It will be recalled that scholars of St. John's School have had three scholarships given to them by Mr. C. Grahame-White.

THE SCREW PROPELLER IN AIR.*

By M. A. S. RIACH.

Introduction.

At the present time there does not appear to be any really adequate theory of the airscrew. The only theory that has been developed recently is the one given by Mr. F. W. Lanchester in a paper to the Institution of Automobile Engineers in April, 1915.† This paper is, moreover, admittedly based on certain theoretical conceptions, and not directly upon aerofoil data obtained from wind channel tests. I have always believed in the possibility of successfully applying aerofoil data to propellers, and any method that attempted to co-ordinate the results of wind channel experiments on model aeroplane wings and on model airscrews appeared to me to be worthy of every encouragement.

It was for these reasons that the so-called blade element method of propeller analysis, in the first instance enunciated by S. Drzewiecki and later developed by Mr. F. W. Lanchester in his work "Aerial Flight," appeared to me to be a step in the desired direction, and the few experiments carried out at the National Physical Laboratory to test the accuracy of the theory, and as published in the Report of 1912-13, led me to believe that the method might with advantage be developed analytically so as to form a reasonably sound basis for the comparison of experimental results and to give to the designer a fairly clear outlook upon the subject. It has always appeared to me that, when testing any theory, however empirical, a distinct advantage is obtained by first stating the whole of the premises, and, having got these clearly defined, to work out the results of the initial assumptions to

discussion which followed the reading of this paper, Mr. Handley Page pointed out that Mr. Low had dealt with the propeller problem from the point of view of what happens to the air as it passes across the blade, considered on the assumption that the blade elements were entering undisturbed and non-accelerating air, and that in reality it did not by any means follow that the lift coefficients and lift-drag ratios taken for the section as tested as an aerofoil in a wind channel would be identical with the results obtained when the section formed part of an airscrew blade revolving in a helical path and encountering disturbed air, and that in consequence the coefficients would require modification to accord with practical results obtained. This, Mr. Page went on to say, really constituted the second half of the problem, and dealt with the question from the point of view of the slip stream on the basis of the Rankine or Froude theory. He expressed the opinion that there should be no antagonism between the two methods of design, but that they should rather be used in conjunction for the correct determination of all the constants of the propeller blade.

It was with a view of co-ordinating these two methods of attacking the problem that led me some time ago to consider whether an advance might not be obtained by utilising both of these theories in an attempt to take into account certain factors ignored in both methods considered separately, and by which the determination of some of the empirical constants used in practical design could be brought about, with the result of more closely co-ordinating theory and experi-

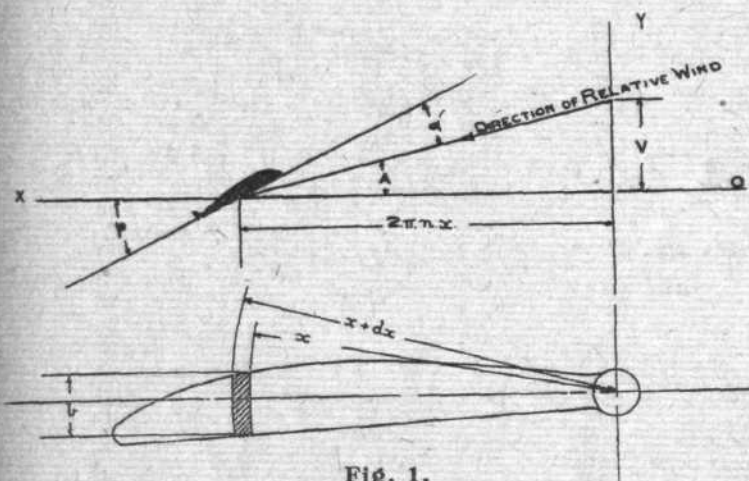


Fig. 1.

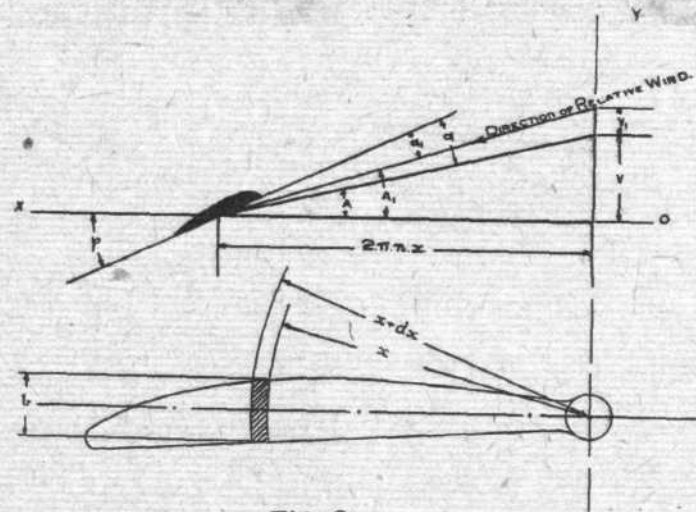


Fig. 2.

their extreme logical conclusions. However approximate a theory may eventually turn out to be, it saves time in the long run to fully develop the theoretical aspect of the subject which is often capable of outlining new methods of attacking the problem, even when the original conceptions upon which the theory was based have been shown to possess no longer a sufficient degree of exactitude.

As an example of this, I might quote the great importance of pitch-ratio upon efficiency in the design of airscrews, and it is difficult to see how such a conclusion could have been arrived at without the help of such analysis as that proposed. As a consequence I was led to investigate the subject from the point of view of the blade element theory, and the results so obtained are given in my book "Airscrews."‡

With the information now available upon the subject it has been found that this method is not sufficiently accurate even for the comparatively "rough-and-ready" methods of commercial propeller design, where the employment of empirical correction factors has been found to be necessary, and although it will probably be found that the theory is still quite a good guide, and, if employed in conjunction with the correct correction factors, may usually be trusted to give quite sufficiently accurate results for the ordinary "hack" propellers demanded of the designer in commercial design work, yet, viewed from the much more rigid standpoint of the degree of accuracy obtained in a laboratory experiment, it must be confessed that the method still leaves much to be desired.

Many will probably remember Mr. A. R. Low's paper on "Airscrews" read before the Society in April, 1913. In the

ment. Before entering upon a detailed discussion of the propeller theory given in this paper, I propose to commence with the formal presentation of the problem, as conceived by the majority of writers upon the subject, notably Rankine and R. E. Froude, and as given in standard text-books on the screw propeller of marine engineering practice. The subject is by no means a non-controversial one, the theory advanced by Mr. R. E. Froude in his papers read before the Institution of Naval Architects in 1889 and 1911 having been violently attacked by Prof. Henderson in the discussion of these two papers and in his own paper of 1910.

General Analysis.

Let:—

V = the speed of advance of the screw relative to the undisturbed fluid.

$V + V_1$ = the speed of the fluid at the actuator disc relative to the screw.

$V + V_1 + V_2$ = the speed of the fluid after passing through the actuator relative to the screw.

M = the mass per second of the fluid through the actuator.

Then, according to R. E. Froude, the thrust on the screw is equal to

$$M \cdot (V_1 + V_2),$$

and the useful work done per second is equal to

$$M \cdot (V_1 + V_2) \cdot V,$$

and the total work done per second is equal to

$$M \cdot (V_1 + V_2) \cdot (V + V_1),$$

and therefore the efficiency is given by

$$\frac{V}{V + V_1}, \text{ and also } V_2/V_1 = 1,$$

i.e., one-half the acceleration takes place in front, and one-half behind the actuator.

*A paper read before the Aeronautical Society on March 21st, 1917.
† "The Screw Propeller," by F. W. Lanchester. April, 1915, I.A.E.
‡ "Airscrews," by M. A. S. Riach.

But, according to Prof. Henderson, the acceleration ahead of the actuator does not contribute to the thrust of the screw, but forms part of a conservative system, and that in consequence the thrust, work and efficiency are given by:—

$$\text{Thrust} = M \cdot V_2$$

$$\text{Useful work/sec.} = M \cdot V_2 \cdot V$$

$$\text{Total work/sec.} = \frac{1}{2} M \cdot [(V + V_1 + V_2)^2 - (V + V_1)^2]$$

$$\text{and therefore efficiency} = \frac{V}{V + V_1 + V_2/2}$$

Owing to the fact, however, that we are unable to determine the values of V_1 and V_2 for each radius along the blade, the foregoing theories are insufficient for the practical design of airscrews, and in consequence one is forced to experiment and its corresponding empirical methods.

THE BLADE ELEMENT THEORY.

The most generally accepted theory of the airscrew at the present time is the one in which the reactions on the blades are calculated from the reactions on elementary strips of the blade, determined on the basis of experimental work carried out in wind channels on aerofoil sections. In this method certain empirical "correction factors" have been found necessary in order to bring calculated results into agreement with those obtained by experiment. It is usual to make allowance for these correction factors either at the commencement or at the end of the analysis in the practical design of airscrew blades. The method of analysis is briefly as follows:—

Let Fig. 1 represent a section in plan and elevation of an airscrew blade cut off by two concentric radii of (x) and $(x + dx)$ respectively.

Let the angle made by the chord of the section with the direction of rotation, or disc of revolution, be denoted by (ϕ) .

Let the airscrew have an axial velocity of (V) in the direction of OY , and let it have a revolution speed of (n) , so that the axial advance per revolution is (V/n) .

Let the angle of the effective helix be (A) , and denote the angle $(\phi - A)$ by (a) , which may then be called the "apparent angle of attack."

It is obvious from the figure that (a) is only the angle between the chord line and the relative wind so long as there is no acceleration of air going on in front of the propeller disc, for otherwise the true "angle of attack" of the section under consideration is less than (a) , due to the inflowing velocity ahead of the screw. It is the variations in the analysis caused by an inflowing axial velocity which make it necessary to employ correction factors, although were it possible to predict the amount of such an inflow, the necessity for such empiricism would probably largely cease to exist. The necessary modification in the analysis to take account of the added axial velocity ahead of the actuator is quite a simple matter, and the trouble is that the amount of such axial velocity is not known. We will therefore start by investigating the geometrical relations which exist between the various component forces assumed to be acting upon an element of an airscrew blade, and for this purpose we will introduce a modification into the preceding statement of the general analysis by considering the effect of an axial velocity (V_1) ahead of the screw disc. Fig. 1 will now become modified as in Fig. 2, and the geometrical statement of the problem is then as follows:—

Let Fig. 2 represent a section in plan and elevation of an airscrew blade cut by two concentric radii of (x) and $(x + dx)$ respectively.

Let the angle made by the chord of the section with the direction of rotation, or disc of revolution, be denoted by (ϕ) .

Let the airscrew have an axial velocity of (V) and a revolution speed of (n) , so that the axial advance per revolution is (V/n) .

Let there be an added axial velocity of inflow (V_1) immediately ahead of the actuator disc.

Let the angle of the effective helix be (A) and denote as before the angle $(\phi - A)$ by (a) so that (a) represents the "angle of attack" of the section when (V_1) is equal to zero. But generally when (V_1) is not zero the real "angle of attack" is not (a) but (a_1) as in the figure, and then, for all positive values of (V_1) , (a_1) is less than (a) , and we may then denote the angle between the disc of revolution and the relative wind by (A_1) . We then have at once the obvious relations:—

$$\phi = A + a = A_1 + a_1$$

$$\text{and } \therefore A_1 = A + a - a_1 = \phi - a_1,$$

and let (b) denote the width of the section at radius (x) . Then we are in a position to at once write down the forces acting upon the element from a consideration of the geometry of the figure.

Let Fig. 3 represent the forces acting upon the section at radius (x) .

(L_1) denotes the lift of the section considered as an aerofoil.

(D_1) " drag " " "

Then the resolved parts of (L_1) and (D_1) in an "axial" direction are:—
 $L_1 \cdot \cos A_1 - D_1 \cdot \sin A_1$

and the resolved parts of these two forces in a transverse direction parallel to the disc of revolution are

$$L_1 \cdot \sin A_1 + D_1 \cdot \cos A_1$$

The first component represents the thrust of the blade element, and the second component represents the torque of the element divided by the radius. We then have the two following equations for the thrust and torque of the blade element. Writing (dT_1) for the thrust, and (dM_1) for the torque we have

$$dT_1 = L_1 \cdot \cos A_1 - D_1 \cdot \sin A_1$$

$$dM_1 = x \cdot (L_1 \cdot \sin A_1 + D_1 \cdot \cos A_1)$$

and the efficiency of the element is given by

$$\rho = \frac{dT_1 \cdot V}{dM_1 \cdot 2 \cdot \pi \cdot n} = \frac{\tan A}{\tan (A_1 + \gamma_1)}$$

where

$$\tan \gamma_1 = \frac{D_1}{L_1}$$

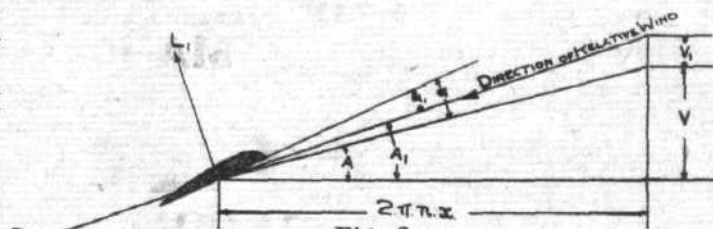


Fig. 3.

Now returning to the thrust and torque equations we see that since (L_1) denotes the elementary lift on the blade at a radius of (x) , we may write

$$L_1 = c_{y1} \cdot \rho \cdot b \cdot dx \cdot v^2$$

$$= c_{y1} \cdot \rho \cdot b \cdot dx \cdot (2 \cdot \pi \cdot n \cdot x)^2 \cdot \sec^2 A_1$$

since $v = 2 \cdot \pi \cdot n \cdot x \cdot \sec A_1$

Where

(c_{y1}) denotes the absolute lift coefficient of the section at radius (x) .

ρ denotes the mass/density of the fluid.

(b) denotes the blade width of the section at radius (x) .

So that for the thrust of the element we have

$$dT_1 = c_{y1} \cdot \rho \cdot b \cdot dx \cdot 4 \cdot \pi^2 \cdot n^2 \cdot x^2 \cdot \sec A_1 \cdot [1 - \tan A_1 \cdot \tan \gamma_1]$$

So that, denoting by (r_0) and (r) the inside and outside blade limits, usually taken to be the boss and tip, we get by integration:—

$$T_1 = 4 \cdot \pi^2 \cdot n^2 \cdot \rho \cdot \int_{r_0}^r c_{y1} \cdot b \cdot x^2 \cdot \sec A_1 \cdot [1 - \tan A_1 \cdot \tan \gamma_1] \cdot dx$$

giving the total thrust on each blade of the airscrew under the conditions imposed by an axial velocity of inflow.

And similarly for the total torque on each blade of an airscrew we have

$$dM_1 = \rho \cdot b \cdot c_{y1} \cdot dx \cdot x^3 \cdot 4 \cdot \pi^2 \cdot n^2 \cdot \sec A_1 \cdot (\tan A_1 + \tan \gamma_1)$$

and therefore the total torque on each blade is given by

$$M_1 = 4 \cdot \pi^2 \cdot n^2 \cdot \rho \cdot \int_{r_0}^r c_{y1} \cdot b \cdot x^3 \cdot \sec A_1 \cdot (\tan A_1 + \tan \gamma_1) \cdot dx$$

and hence the brake horse-power (H) necessary to turn the airscrew is given by, denoting by (N) the number of blades,

$$H = \frac{N \cdot 8 \cdot \pi^3 \cdot n^3 \cdot \rho \cdot \int_{r_0}^r c_{y1} \cdot b \cdot x^3 \cdot \sec A_1 \cdot (\tan A_1 + \tan \gamma_1) \cdot dx}{550}$$

in lb., foot, second, units and where (ρ) has the value of $(\cdot 00238)$.

The total efficiency of the whole blade is obtained as follows from the ratio-total useful work done per second to total work put in per second.

$$\eta = \frac{V \cdot \int_{r_0}^r c_{y1} \cdot b \cdot x^2 \cdot \sec A_1 \cdot (1 - \tan A_1 \cdot \tan \gamma_1) \cdot dx}{2 \cdot \pi \cdot n \cdot \int_{r_0}^r c_{y1} \cdot b \cdot x^3 \cdot \sec A_1 \cdot (\tan A_1 + \tan \gamma_1) \cdot dx}$$

Now none of these formulæ can be applied unless the value of (V_1) for every radius (x) is known, so that (A_1) and its functions are also known. This brief summary of the geometrical analysis forms what may be termed the blade element aerofoil portion of the theory as enunciated in this paper, and is by way of being a mathematical tool for the investigation of problems of this nature, provided that the required values of the inflow velocity at each radius are known.

(To be continued.)

AVIATION IN PARLIAMENT.

British Air Services on the Western Front.

MR. BILLING, in the House of Commons on March 13th, asked the Under-Secretary of State for War whether the recent statement of General Sir Douglas Haig that no German airman dare show himself over our lines holds good to-day; whether he is now in a position to assure the House that the same marked superiority of our Air Service at the Front exists to-day as was the case six months ago; if Sir Douglas Haig's requirements for aeroplanes have been fulfilled; and, if so, will he explain why the German recent tactics have come as a surprise to our General Staff?

MR. MACPHERSON: The War Office has no knowledge that any such statement has been made with the authority of Sir D. Haig. As regards the second part of the question, I would refer the hon. member to the statement which I made this afternoon in answer to a question by my right hon. friend the member for Kirkcaldy Burghs. As regards the third part, the programme is not yet completed, and the requirements are altered from time to time. The recent German tactics have not come as a surprise to the General Staff.

General Sir David Henderson.

MR. BILLING asked the Under-Secretary of State for War whether he is aware of the general dissatisfaction that exists throughout the Royal Flying Corps as to the administration of General Sir David Henderson, Director of Military Aeronautics; and, seeing that the friction occasioned thereby is impeding output and efficiency, whether he will consider the advisability of finding another sphere for this general?

MR. MACPHERSON: The Government have full confidence in the administration of Lieutenant-General Sir David Henderson.

Air Services.

SPEAKING on the motion for the Adjournment on March 13th, Mr. Billing said: I wish to express my regret for again having to detain the House on the question of our Air Services, but I think it is of as great importance as the business which has just been before the House. I should like to take the very first opportunity I have of congratulating the Under-Secretary of State for War on the frank statement which he made in the House this afternoon. Had we had such a frank statement from his predecessor twelve months ago the position of our Air Service would have been very different to what it is to-day. I would like to point out that, on his own admission, the hon. gentleman was quite unable to give any further facts than those he stated which I am quite sure satisfied this House, that the answer which he gave to my question had been very carefully prepared. I have had some experience in preparing answers to questions when I was at the other end, and I can readily imagine who prepared the answer to that question for the hon. gentleman to come to this House and read. The answer was prepared by the Director of Military Aeronautics, and I would like to point out that out of his own mouth he stands condemned. If we review the answer quite briefly, what is the first thing we find? It is that in the last six weeks 7.6 of our pilots have been killed, 8.3 have been wounded, and 4.2 are missing. I asked the hon. gentleman whether he could tell me whether that average was taken on the whole of our Air Service, naval and military, including the thousands of airmen and machines which are in this country, or whether it was taken on the machines and men in France, and, if so, whether it was taken on the fighting efficiency of those men and machines in France. Assuming that the Director-General of Military Aeronautics made the very best case that he could in answer to the right hon. gentleman the member for Kirkcaldy Burghs (Sir H. Dalziel), it is a very serious statement. It means that we have lost in six weeks 20 per cent. of our men, because the total comes to 20.2 per cent. of the personnel of the Air Service. It means that if this goes on in this way then in six weeks the whole Air Service will be wiped out. That is rather an alarming statement.

The Director of Military Aeronautics cannot say that he has not been warned. It is twelve months ago to-morrow that I first presumed to warn him from the floor of this House, and I and other hon. members have continually warned him, that certain machines were inefficient, and that certain methods which he was employing in France and in this country were inefficient. Yet he persisted in this administration. What is the position to-day? I would like to suggest to the hon. gentleman on the Front Bench that the majority of these fatalities can be directly attributed to machines by being sent up in which I said twelve months ago that our men were being murdered. I stand here twelve months later, and I say even on this very day that men are being murdered by being sent up in these machines. Our men are to-day being sent up in B.E.2 gun spotting. These machines are utterly incapable, armed and equipped as they are, of rising over 5,000 ft. They are sent up with two 20-lb. bombs, and two guns fitted on them. The guns, however, are not adequately fitted for fighting. These machines are sent 6 miles out into the enemy's lines. Only recently I had two or three cases brought to my notice of men sent out gun-spotting, and with them they had two of what are called chasing machines, but they lost the chasing machines, they stopped over the lines at the mercy of the German airmen, and they were eventually shot down. Quite recently two fell in flames in our own lines. I do protest that after twelve months of warning the administration of our Air Service should still permit of this type of machine being used when we have the finest types in the world in this country. We have machines faster than any the Germans have at the Front at the present time, while we are sending men up in machines to engage Germans when they have to meet machines which are 40 or 50 miles faster and can climb 3 ft. to their 1 ft., and which are also properly armed and properly equipped. I want to call the attention of this House to the administration that permits it.

We are told we are substituting as quickly as possible other machines for those by which the lives of our men are being thrown away uselessly. But what are the facts? Quite recently an order has been placed for 250 more of these machines with 90 h.p. engines. They will not be delivered for months, and if they were in use to-day these 90 h.p. engines would have to meet 200 h.p. engines of the enemy. On the other side we have the private constructor.

I put a question yesterday as to when the Sopwith tri-plane chaser—one of the Puff machines, as they are called—was first offered to the Admiralty and when it was ordered. Also how many we have got now in the service of these machines, which can make rings round those turned out by the Government. What was the reply? That it was not in the interest of the country that a reply should be given. If the answer had been that it was not in the interest of Sir David Henderson, I think the answer would have been more correct. That machine was brought out in April, 1915. When I was in France at the time that machine was being tested, and the Nieuport was brought out in competition with it. That machine was offered to the Government and sent down to Farnborough to be tested. It was messed and muddled and played with, and yet its performance was perfectly extraordinary, flying about 2,200 ft. in the first minute and reaching a speed of 117 or 118 miles an hour. That was in April, 1915. As a matter of fact, in October, 1915, I understand that the Royal Flying Corps laid down two squadrons of them, on paper. I challenge the hon. gentleman on the Government Bench to say that there is one of those machines in France to-day. I will challenge him to say that there is one of them that has ever been delivered. Their delivery has been held up while we were taking delivery of these Government-designed machines, which are responsible for the loss of the supremacy of the air—if we ever had it—in France to-day.

What happened only yesterday? I put down that question, and the order I understand, has been cancelled. The whole order has been deleted. Hundreds of these machines have been laid down. Of none of them has delivery been taken. What is going to be done with those machines? Are they to be burnt, like we burnt thousands of them? When I asked the hon. member on the Front Bench yesterday how many orders he had deleted in the last 12 months, he replied that it was not in the public interest to tell me, because, he said, that if Germany knew how many we had burnt they would know how many we had. I fail to follow at all that course of reasoning. We have been buying machines in hundreds. When the Navy had the first call on the 200 Rolls engines they built a series of bomb-droppers that cost the country some thousands of pounds each. Because the Army could not get possession of the engines they eventually got possession of all these new machines. They sent their pilots down to Eastchurch and they got into these brand new machines, flying them to Farnborough, where they pulled the engines out and burnt the whole lot. They are doing that the whole day long. If any new expert gets temporary power at one of these offices he immediately burns everything the last man built. [An hon. member: "Why not?"]

What is the position as between the two Services? Will the mastery of the air ever be won on partisan lines? There is a naval expert who sits in one room at the Hotel Cecil and a military expert who sits in another room. The stresses, strains and calculations which one expert demands he insists upon. The Navy passes that machine as fit for active service, but if it is handed over to the Army, they immediately scrap it because they say, "We do not approve of these spring lines or that wire." To show that there is no love lost between them, when the Army hand a machine over to the Navy they act in exactly the same manner. The requirements of one Service are entirely different to the requirements laid down by the other Service. I would appeal to the House to take this matter seriously now. We do not want any more public inquiries. We have had quite enough of the fallacy of public inquiries. A Committee of this House might well inquire into the matter—not a Committee appointed by the people who are in question, but a Committee appointed by the House might inquire into the administration and command of the Royal Flying Corps and the Royal Naval Air Service with considerable advantage to the cause for which we are fighting. General Henderson—presumably it is he who makes the statement—says:

"The situation in the air on the British front in France at the moment is as undecided as during the winter months."

I understood that during the winter months we were supreme in the air. He said later:—

"The situation is very similar to that which obtained in the same period last year, when at that time the Germans, reinforced and rested during the winter, put up a serious opposition."

If that is all the advance we have made in twelve months I am sorry. I think if he had said while we rested the Germans worked and prepared it would give a better answer to what is taking place in France to-day.

"At the opening of last year's campaign the main German concentration was before Verdun."

That is a contradiction in terms. Here, I admit, that last year although we were beaten out of the air for a considerable period in the spring, the main German air offensive was at Verdun, and we claim the supremacy of the air to-day. We do not take into consideration that the German air service is not only keeping the British air service at bay, but the Russian and the French, which is a far greater air service than ours, and it is keeping the air service of Italy and what little Roumania has got and all the various Allies. I do not know whether I shall ever be able to impress upon the House the importance and the urgency of taking up this problem seriously. I do not want to repeat the many arguments I have put forward in support of that, but I appeal to the Under-Secretary to inquire very closely into the actual conditions obtaining in France at the present time, and I tell him that I shall raise this question of the air on every available occasion until such time as we have regained that supremacy which for a few brief months, after as many months' agitation, we gained in the summer of last year.

The Under-Secretary of State for War (Mr. Macpherson): I have no reason personally to complain of the remarks which my hon. friend has made about me. I endeavoured, in the answer which I gave to-day, to give the facts of the case as honestly and as concisely as I possibly could within the limits of a question and answer. But while I am grateful to him for his generous appreciation of what he terms my honesty in my statement, I must say that appreciation is considerably detracted from when I find him making a most violent and bitter attack upon a colleague of mine on the Army Council. He has spoilt what might or might not be a good case by his exaggeration of statement. He has accused the Army Council of murdering British airmen. I defy him to produce one single instance of the murdering of a British airman in France or in this country. The hon. gentleman made the same statement before in such a way as to force the Government to appoint a judicial inquiry.

MR. BILLING: Not judicial at my request.

MR. MACPHERSON: I am within the recollection of members of this House. The hon. gentleman forced the late Government to appoint a judicial inquiry, presided over by a High Court judge, with assessors who were men of skilled knowledge in engineering. He was asked to substantiate the accusations which he made in this House, and nobody knows better than the hon. gentleman that he failed, and completely failed, to substantiate those accusations. Notwithstanding that lesson which he received at the hands of the judicial tribunal, for which he himself pleaded, he comes forward again and makes the same rash and reckless statements. I can assure my hon. friend that it does grieve anybody who is anxious that these gallant fellows who are fighting for us at the front should not be handicapped when we find the hon. member coming forward at this time of night and rashly and recklessly making statements which only serve to impede their gallantry and break down their morale for which they have become famous all over the world. I again ask the hon. member to come forward and substantiate the statements which he has made.

MR. BILLING: I shall have very much pleasure in giving my hon. friend privately a great deal of information which I prefer not to give in this House.

MR. MACPHERSON: I must say, speaking on behalf of the Air Service, that I am afraid the evidence which my hon. friend would bring forward would receive the same fate at the hands of a judicial inquiry as did the evidence which he brought before the other judicial inquiry.

I do not know whether the hon. member would like us to have another inquiry into the statements which he has so rashly made before the House to-night.

MR. BILLING: I should, indeed.

MR. MACPHERSON: The hon. member said a few minutes ago that he did not want one.

MR. BILLING: Not a judicial inquiry. I want an inquiry by experts who understand aviation and who have seen flying.

MR. MACPHERSON: What sort of inquiry does the hon. member want? He knows perfectly well that he was satisfied with the judicial inquiry when we promised it, and when we promised to appoint a High Court judge to preside, with skilled assessors to assist him.

MR. BILLING: No. I protested fiercely against it.

MR. MACPHERSON: In any case the hon. gentleman came forward and submitted himself to that inquiry, and I hope that he was satisfied with the result

He went on again to attack Sir David Henderson. He is probably the only man in this country who is supposed to know anything about the Air Service who has gone out of his way to attack Sir David Henderson. Everybody in the country knows that the splendid efficiency of the Air Service is due in the largest measure to Sir David Henderson. He has grown up with our Air Service. If you were to ask anybody in the Air Service to-day, whatever his position, one and all would admit that the one great benefactor of the Service, who has made it the splendid Service which it is, and has made it the envy of the other branches of our Armies, as it is to-day, is Sir David Henderson.

Speaking in the debate on March 15th on the Supplementary Vote of Credit, Mr. Billing said: I do not know whether the hon. member who represents the Air Service in this House thought there was any likelihood of the question of the manufacture of machines being raised on the Munitions Vote in Committee of Supply to-day, but I think it is a question which ought to be raised. I submit to the Chancellor of the Exchequer that the whole of the money for which he is asking for the purpose of munitions could be well spent on the provision of aeroplanes, and I would like to take this opportunity to call his attention not only to the amount that it is advisable to spend on the production of aeroplanes, but to the vast amount of money now being wasted on the production of aeroplanes. I do not know whether the House is aware of the cost of an aeroplane to this country—I mean the cost of a fighting aeroplane actually in the lines. I think, if they were, they would give very careful consideration to the voting of money for that purpose. It may be generally accepted that when an ordinary aeroplane is in the air over the German lines, if that machine is shot down, it is a dead loss to this country of something like £25,000. If we number all the effective aeroplanes that are fighting on the Western Front now, and if we divide that number by the total cost of our Air Service up to the present day, we shall find that every one of those machines has cost anything between £25,000 and £30,000. When an airman is shot down to-day it is a generally accepted idea that we have only lost one man and one machine, but the fact is that the country, apart from losing a skilled aviator—and in the present circumstances of training aviators are needlessly expensive—has also lost about £25,000 or £30,000 by the process. That is why I submit that the greatest care and the greatest control should be exercised as to the type of machine upon which this money is to be spent. What do we find? At the outbreak of this war the Government had decided on a certain type of Government-designed machine. Lack of experience in active service conditions had decided them to standardise a certain type of machine which had been proved to their own satisfaction. Within three months there was satisfactory evidence at the Front that the type of machine upon which this country had expended millions was useless for the purpose for which it was necessary to employ them.

Those were the machines upon which the Government chose to pin their faith. I would not have raised this point if it were not for the fact that, despite two and a half years' warning, they still continue to pin their faith to the same type of machine. What makes me rather hot and bothered is that some of the £18,000,000 which the Chancellor of the Exchequer has asked the House to vote to-day may be squandered in the building of the very machines that I object to, and to which practically every man outside the Government employs—and by that I limit it to the civil Government employees—and practically every military aeronautical expert so strongly and so fearlessly objects. First of all, this is not on a point of efficiency, but on a point of economy, which I am sure the Committee is most anxious should be studied, provided that efficiency is not affected, in the conduct of the Air Service as well as in other branches of the war. The initial cost of these particular types of Government machines is something like half as much again, and in some cases it is twice as much as that of machines of private design, which are infinitely superior, both in length of life and in performance as well as in ability as fighting machines. Why should they persist in ordering these Government machines? I think that it may be attributed to this cause, that in the early days before the war and in the early days of the war, General Sir David Henderson found himself at the head of a service which he did not understand. He had practically no flying experience whatsoever before the war, beyond about three circuits round—

Major Collins: Is an hon. member of this House entitled to cast reflections upon a soldier who is employed on the active service of the Crown?

The Chairman: That is not a point of order. The hon. member has strong opinions on the point, and it is not for the Chair.

Mr. Billing: I never intend to use my seat in this House to cast personal reflections on any man, but when a man's administration is costing this country millions of pounds, I think it necessary to raise the question of his administration. That was General Sir David Henderson's experience when this war broke out. The result was that he had to call for the advice and assistance of somebody. I will say nothing more than that he was most unfortunate in deciding on the man whom he eventually called in, Lieutenant-Colonel O'Gorman, at the factory at Farnborough. Mr. O'Gorman had spent a great deal of time in developing this particular type of machine, which was at the same time the most complicated and the least efficient machine. Naturally, he advised Sir David Henderson to build machines of this type in large numbers. The manufacturers in the country—there were not many of them, thanks to the encouragement received from the Liberal Government in past years, most of them were looking round the corner of Carey Street—were called in and told that they must build these machines. Everybody offered to build them, because they wanted to get the orders. They went nap on the official machine, and the result has been so great a loss to this country through this war that it would require very considerable imagination and very careful study to ascertain what it is.

The action of Sir David Henderson at the outbreak of this war in, for some reason or other which may be traced to the factory at Farnborough, deciding on standardising the wrong type of machine, despite the advice received from every other quarter, has cost this country not only hundreds of pilots and thousands of lives of our men, hundreds of thousands of men killed or wounded, for the simple reason that it interfered with our gun-spotting, and with the movement of our troops, and, to a great extent, made our Army shortsighted instead of long-sighted. It is not purely from the point of view of the air offensive that the question of the Air Service looms so large. If to-day for some reason or other we lost our Air Service entirely, our Army would be beaten in a month, for the simple reason that if the enemy could see our movements, and our Army could not see the movements of the enemy, our Army would be fighting under insurmountable difficulties. Yet the Under-Secretary for War informed the House the other day that we are losing men at the rate of 20 per cent. per week, and if only this House will insist that details of those losses shall be given, details of the number of men who lost their lives on Government designed machines, who have been missed on Government designed machines, I am perfectly satisfied that this House would see that these Government designed machines were costing this country millions of money and thousands of lives. Yet we still have Sir David Henderson ordering these same machines, and despite the fact that twelve months ago there was a considerable agitation against them.

I understand that a certain firm in the West of England have just had refused their offer to build a type of machine, a monoplane, which is capable of a speed of 132 miles and of climbing over 2,000 ft. a minute, which has a better performance at 12,000 ft. than it has at 5,000 ft., which is a very considerable gain, and which could be turned out at the rate of ten per week. Instead of being allowed to supply that machine, I understand that they have been given an order to build 250 machines which will take twice as long to produce as 250

of the other kind, which will cost this country twice as much in prime cost, which, when they are finished, will be fitted with 90 h.p. engines, which will have a speed of about 85 miles an hour, and climb at about the rate of something like 800 ft. a minute. I do not wish to go into technical details, but the House will readily understand that to order machines which are only capable of that performance for delivery in two or three months, and to send those machines over to France and send our men up in them with engines of 70, 80 or 90 h.p., to meet German machines with 200 h.p., is not playing the game by our men. Assuming that the best brain power of our country could produce nothing better, there might be some excuse. But there is no excuse when you think that we might produce as good as anything that the Germans could produce, and that we have produced, in two or three instances in this country, machines which are infinitely superior to anything that the Germans have produced.

A certain firm not very far from this City produced a machine with an extraordinary performance, which I understand has been nicknamed the "Camel." When I asked certain officers why it was called the "Camel" they said it was because it gave the official designers the hump. That just about explains the position of the official designers. Nothing breaks their hearts so much as to hear that a private designer has brought out a machine that will beat their effort. This sort of thing has got to stop. At the present moment it is the policy of the Royal Flying Corps to take over all the land machines from the Navy. The Navy are placing large orders for land machines, or they were until quite recently. When these machines are delivered, after a great deal of exchange of papers and documents, they will be assigned to the Royal Flying Corps. Before those orders were placed there were certain officials—I shall be quite willing to hand their names to any hon. member on the Front Bench—whose duty it is to work out, by the most elaborate procedure, the stresses and strains of those machines. They can work out slide calculations and go into the differential calculus and aerodynamics. They are most mysterious people; you could hardly understand them at all. The naval representative says, "We shall pass this design. This machine shall be permitted." After those machines are ordered, it is discovered that the duty of the Navy is essentially on the sea, and that machines should be built to help the Navy, as distinct from devilling for the Army and so it is decided that these two or three hundred machines must be immediately taken over by the Royal Flying Corps. Then military experts in the Royal Flying Corps are called in and told that these 300 machines are going to be drafted across to them. They ask for the drawings and calculations and work out their own calculations, and they say "We cannot have this or that; it is not efficient." They have a different scale of standardisation, and what will suit the Navy will not suit them. But these 200 or 300 hundred machines have to be handed over to the Army, and they go to the Army. And then what happens? The Army will not have them, the engines are taken out of them, and they are burned.

Mr. Lynch: May I ask the hon. member is it that they have a different mode of calculation, or is it that they have a different factor of safety, because the principles of dynamics are naturally the same in each case?

Mr. Billing: I am very glad that that question has been put. Of course, they both use the same type of sliding rule, they both arrive at their calculations in the same way, but one expert may say that he is in favour of getting his strength by putting in a deeper spar and another man may want to put in a shallower spar and gain his strength by putting in struts. They will differ considerably in details. They may both be working on the same principles, but the details of design are quite different, because one technical man may gamble on steel tube struts, and the next technical man may gamble on another kind, and for certain purposes another says that stream-line wire is the best. The result is that when one expert gets on to the work of another he immediately scraps it, principally because he has always stood for stream-line wire, and how could he consent to these machines which have not got it being taken over? That is the point I am trying to get at. We should have one technical department concerned only and absolutely with aero-motor planes. If the Royal Naval Air Service is to be of the slightest use to the Royal Navy it should be in a position to serve the Grand Fleet, and to supply it with eyes. What do we find? Scarcely 20 per cent. of the entire Royal Naval Air Service is on active service at all, one-half being engaged on aeroplane carriers, and the other in connection with the Royal Flying Corps. I do not want to say anything which would be of use to the enemy, but if we want our Grand Fleet to operate when called upon it should not be unnecessarily handicapped by anything which the intelligence and foresight of the Admiralty could prevent. I do ask the Royal Naval Air Service to stop devilling for the Army in France, to stop squandering thousands or millions of pounds in building land machines which are transferred to the Army, to stop experimental work on land, and to develop all the strength and ability they possess, so that they may be of some use to the Grand Fleet, for that is the reason why the Royal Naval Air Service was called into being. If they would conduct experiments on the production of seaplanes, or small machines, capable of alighting upon ships, then they should really receive some encouragement. But it is not so.

When I was in the service we were told that it was possible to construct a small aeroplane which could land on wires between the masts. We actually conducted an experiment with an old-fashioned machine, and when it was ascertained that the experiment was a success everybody concerned received congratulations; but nothing further was done. I do not think any better step could be taken than to give the Admiralty its own Air Service, distinguishing naval lieutenants with the letter "F" as designating flying officers in the Royal Naval Air Service. This would tend to defeat the friction and intrigue which is at present aroused by the difference which has been introduced in connection with the promotion of officers in the Royal Flying Corps, submarine officers, and general service officers. If the suggestions which I make were carried into effect we should at least clear the air of intrigue. I do not know that I should use the word "intrigue," for it seems a somewhat unfortunate word to employ—it is an unpleasant one—but the fact is that not only do I know that intrigue does exist, but my knowledge leads me to excuse it and to quite understand why it takes place. It is this, that all the chiefs are asking for it, and it is right they should have it. If it is desired that the Naval Air Service should be better handled, it should be put back into the hands of the Admiralty, and it should stop there. Serious steps could then be taken to remove the outward and visible signs and the inward signs of dissension, and with such an arrangement our Air Force would be something like a real service, freed from the faction which exists at the present time. Everybody considered that, once we had Lord Cowdray, everything would go well. I do not know that Lord Cowdray had ever studied an aeroplane in his life; I doubt whether he ever discussed it, and I doubt whether he ever went up in one, and I believe the duties got beyond his strength. If I were totally ignorant of a subject I should seek those men who did understand it, and Lord Cowdray is surrounded by a multitude of councillors, nearly all more or less able, but all with little peculiarities, characteristics, hobbies, and methods which they would like to use in the administration of the Department. Where a man is giving advice he sometimes goes a little further than if he were acting in his own behalf, because he says to himself that if his advice turns out to be a success he gets the credit of it, but if it is a failure he does not suffer. For myself, I cannot imagine anything more likely to cause us not only to lose but never to regain our supremacy in the air, either in France or elsewhere, or to provide our Navy with adequate eyes, so long as the present contention goes on in the Hotel Cecil.

I would suggest that some consideration should immediately be given by the Government to the formation of an air policy. We have no policy at present—no more an air policy than we have a general policy in the Government. Surely

the Government must understand how exceedingly difficult it is to run this country with Government Departments warring against each other—one Department ignorant of what the other is doing till it sees something in the daily Press, and finds that the Secretary of State for War has done something entirely opposite to what had been done for the Grand Fleet. It would be much better if we had a director of the Air Services who would find out what policy should be adopted, and conduct it so that we might no longer suffer the inconvenience of indecision and of the warring opinion of twenty Departments. My experience of the conduct of Departmental business is that no matter how you may run it, if there is a dissatisfied man somewhere he will be a block. Time after time in the Admiralty I have seen papers thrown into the basket because some officer did not like the person concerned. No notice would be taken of the papers, till eventually they are sent to another Department, and they go round the Admiralty and come back to him. Then he sends them to some other Department, and they go round the Admiralty again. I know cases of documents which have travelled round the Admiralty for weeks and months simply to hold them up or perhaps simply because the representative of some firm has offended some little jack-in-office—perhaps had been short with him, or not paid him that due deference to which he thought he was entitled. So the firm's papers are shoved aside, or held up, or go wandering round the Admiralty, and the production of a hundred aeroplanes may be stopped that some small official may be gratified. That sort of thing does not happen if you have got good feeling through the Services; but the Army are always jealous of the Navy and the Navy of the Army, and they will always be so, I suppose. It is a fine thing it should be so, but let us take advantage of that spirit of rivalry between the Services and create another service which in its turn, if you like, may be jealous of both, so that we will have some more rivalry. I think the time has come when we must recognise that the air is one element so far as an offensive or defensive question is concerned. The French have had to recognise it, and have held a Secret Session, and their Minister of War has resigned. I would appeal to this House to go into Secret Session. There are quite a number of questions which it is exceedingly difficult to raise in open Debate. I know that members feel that when there is no Press Gallery reporting them it is not worth their while talking. I think that rather a pity, since there are points affecting the numbers of machines which we employ, the training of the men and where and how they are trained, the enormous losses which we are actually sustaining, and matters of that kind, which would be better discussed in a Secret Session. If not a Secret Session, then a Committee of members might be appointed. It is only a year ago since, in my maiden speech, I think, I suggested that a Committee of members of this House should be appointed, by the House and not by officials who are endeavouring to cover their tracks, to inquire very closely into and to represent, if necessary, the Air Service in this House. I would ask that some such thing should be done. I am perfectly confident if 12 months ago we had taken this question seriously and had scrapped all the rubbish—and here I would call the attention of the Financial Secretary to the Admiralty to the various aeronautical abortions costing millions—if, I say, ten or fifteen hard-headed men in this House, whether they understood aviation or not, simply went into the matter, I think something would have been done.

I should like to see a profit and loss account of what has actually been accomplished and what has been spent by the Royal Naval Air Service. I think we should find that every 100 they had killed cost £20,000 or £30,000, or more. They are wasting their time at present and are operating over land which they were never intended to operate over. Only last week I found there was a captain in the Royal Flying Corps, a first-class man in the merchant service and a skipper who thoroughly understands the sea. While in the Royal Naval Air Service you find people who would get sick if they had to row over to the aeroplane and who have never been to sea and know nothing about it. The whole thing is that you have got this festering sore of intrigue, and men know that if they only keep on the right side of the man who is pulling the strings they will be all right if things go well. We do not want that. We want a director of air. I suggest to the Front Bench that they have got 20 men to choose from—first-class, experienced soldiers and sailors, not necessarily generals or admirals. I think this is a war of the younger idea. I think that it is time that a great many of the more or less aged gentlemen who are conducting this War on our behalf were pensioned off. I never heard of very, very old generals or very, very old admirals making very much headway in the problems of a long and exhausting war which this is.

I would recommend the Front Bench to take some trouble to enquire as to the material they have in the way of personnel. We have the finest material in personnel in the world in this country. Our pilots are perfectly priceless both in the Army and the Navy. They are willing to go anywhere and do anything. In the Navy they are lost and bewildered with no policy, or what little of policy there is is changed from day to day. Directly there is any change of grade or command the entire policy of the Department changes. If we had a man at the head of affairs who laid down a strict concrete policy as to the building of so many machines for such and such purposes to do particular things there would be no time for intrigue or for all the various experts to be quarrelling with one another. If this question had been taken seriously at the outbreak of war the war would have been over by now, and if it had been taken seriously when I first came to this House twelve months ago the war would be nearly over to-day. If instead of fooling like we have we had laid down 20,000 aeroplanes twelve months ago, we should be getting deliveries now in such quantities which would enable us to initiate such an offensive against the Germans that we would have struck terror in their hearts. We have not experienced any decent daylight raids here yet. I know it is a brave thing to go up aloft, and we know how our people have behaved in connection with the raids; and I can assure you that the morale of the German civilians is not as high as ours. If hon. gentlemen on the Front Bench care to come and look over a map, I will point out parts of Bavaria on which a little bit of healthy bomb-dropping on some of their towns would do more to bring this war to an end than dropping as many thousands of tons of munitions on the Western Front. I am perfectly confident, if we want to humble the German nation, the air is the weapon to employ. I am confident that 12,000 aeroplanes with men could have been secured in twelve months.

There are only three types of aeroplanes. There is the observing aeroplane for gun-spotting and general observation, and those are wanted in very small quantities. They can be improved from time to time. There is the chaser machine, in which it is absolutely necessary to improve and produce new types. You can never go to work too fast on the production of fighting aeroplanes. Then there is the bomb-dropper, which could be standardised for the next two years. We have got a bomb-dropper to-day which can operate at from 15,000 ft. to 18,000 ft., and can fly with a 500-lb. bomb about 400 miles at a speed of about 88 miles per hour. That speed can be increased if you lower the altitude, which you can do if the bomb-dropper is properly guarded by chasers to protect it. That type of machine would be quite good enough for bomb-dropping expeditions in six months or twelve months or eighteen months' time. Why cannot we build a thousand or two of them, and before we build them, why can we not sit down and make some definite plan of war? At the present time a firm goes knocking to the Admiralty or the War Office or the Hotel Cecil for orders, and in order to put them off someone gives them an order, and when they have got the machines they have no idea what to do with them. They do not know whether to keep them or make a big paper army. Take the question of these Sopwith biplanes, which was putting up the most wonderful record of any machine. They were sent down to be tested in April, and May, June, July, August, September, and October passed before they were tested, although the testing is a job that could have been carried out in 36 hours. They ought to have had 200 of those machines at once; and

before they were ordered those people who are responsible for our policy, whatever it is—if there is such a thing—as to the conduct of this war in the air ought to have been told that "here we have a machine capable of doing this, that, or the other, and how can we employ 200 of them, and can we by them bring this war one day nearer to an end by bombing this place or that, or by carrying out some great offensive stroke?" Then, if the War Office or the authorities were satisfied that something could be done, those machines could have been ordered and delivered and a new type employed in six months. Some time in October that order is placed, and two paper squadrons are ready in the Royal Flying Corps. If you went down to the Hotel Cecil now you would find those two paper squadrons there, if they have not washed them out, with their officers, their C.O.'s, their men, their aeroplanes, and everything else. The whole elaborate procedure is gone on with, and if you ask why those squadrons do not turn out and where are the machines, they have to admit that most of them are not built or delivered. In April, 1916, that machine of which I have spoken was perfect and ready for the air, and here in April, 1917, practically 12 months afterwards, I defy the War Office to say that there is one in their concern or one delivered. If they ordered these vast quantities, why are they not ready? If they did not order them, why did they not order them? I only heard two days ago that the whole order had been washed out because the firm had brought out a machine just a little better. That is quite understandable, but why do not we work on some system? If we standardised that type of machines for six months, at the end of that time we could review the position, and if someone had brought out in that period a machine the performance of which was so much better as to justify us in the loss of production which a change of type must always cause, then we should do it.

In 1914, I suggested to the Admiralty that we should use some form of standardisation for the production of machines, yet even at the present time, if you go round the factories of this country, you will find highly-skilled bench hands filing away at one or two fittings at an old cross-cut file, whereas if the thing was properly handled in Birmingham they could stamp the fittings out by millions a day, yet each little firm has its own little file and metal plant up and down the country. I shall never stop pleading on every occasion that presents itself, pleading the cause of standardisation of type and the employment of some definite offensive policy, of a constructive programme, and the creation of a single Air Service for carrying it out. If any member of the Air Board can satisfy this House that all is well in the Hotel Cecil I shall be very much surprised. I know quite well that, if anything, it is totally the reverse, and what is one to do? What can one do? If I as an Englishman know these facts to be so and know that we are squandering millions of money and throwing away thousands of lives, when I know that my own friends are being shot down in flames over our own lines day after day, with a casualty list, even on the admission of the Front Bench, of 20 per cent. of our total efficiency in one week, which means the wiping out of an Air Service in five weeks—when you know all that to be true, I ask what can a single member of this House do if the other members will not give the matter the very serious attention that it deserves?

I call upon the Government to initiate now a strong air offensive, and not only on the Western Front. If the Government have any political or religious scruples about employing the same methods of warfare as are being used against us, I wish they would say so. Personally, I consider that the dropping of bombs on munition works and towns and houses which house munition workers is a legitimate act of war, and if by employing those means we can bring this war to an end even a week earlier, I think it is a cruel act of us not to employ them. I think that any offensive in the air which can be carried out over the enemy's country will have a very excellent effect. We were told by our morning papers that the German nation were getting demoralised and that they were rioting, and, in fact, that all was nearly over but the shouting, but if we had enough aeroplanes to send over 5,000 to-morrow I think there would be nothing to do but the shouting. But, quite apart from whether they are demoralised or not, I contend that they would very soon become demoralised if such an offensive took place. I ask this House to give this matter their serious consideration, and not to dismiss it in relief when I sit down. I put down a question in this House in regard to Haig's requirements for the Air Service, and they had to admit that the requirements that Field-Marshal Haig made have not been fulfilled. The General Staff made certain demands some months ago for certain aeroplanes to fulfil certain duties—

Sir Godfrey Baring: On a point of Order, Sir. On a very important Debate of this kind, when the time is severely limited, is there any means of limiting the speech of the hon. member?

The Chairman: The hon. member has spoken for an hour and five minutes, but I do not know that it is in the hands of the Chair to put limits to a speech without the passing of a Standing Order.

Mr. Billing: I will not detain the House very much longer, but it is not very often that I do detain them. If the Commander-in-Chief in France makes certain demands for certain munitions of war and they are not forthcoming, someone is responsible, and I want to know who that man is. The man who is responsible for not producing has got to bring forth some excuse, and if his only excuse is that there is so much intrigue and trouble in the service that he cannot produce the stuff that the General Staff want, then that man has got to go. I will ask the Financial Secretary to the War Office whether it is not necessary at this stage in the war to have a very careful, not public, but private, enquiry into the administration and command of General Sir David Henderson, and whether, if the facts are as I state—and I shall be very glad to render any assistance I can to see that justice is done—he would believe that he would be serving his country well in finding another sphere for his activities.

Training Aeroplanes.

MR. INGLEBY on March 15th asked the Parliamentary Representative of the Air Board whether the Avro and other aeroplanes are still being fitted with English-made Gnome engines; what is the number of accidents that can be traced to the use of this engine in training squadrons; and if its use is to be continued?

Major Baird: The engine referred to is still in use, though it is gradually being replaced. The number of accidents which occur to machines fitted with this engine is not proportionately greater than to machines fitted with any other engine used for training purposes.

The War Cabinet and the Air Board.

MR. CECIL HARMSWORTH asked the Prime Minister whether, when naval and military officers are summoned in an advisory capacity to meetings of the War Cabinet, their opinions on matters of naval and military policy are now explicitly and exhaustively ascertained; and whether officers of junior rank attending such conferences are regarded as entitled to express their independent opinions in the presence of their superiors in official rank?

Mr. Bonar Law: The answer to the first part of the question is in the affirmative. As regards the second part, it has been found necessary on occasion for witnesses or experts to attend meetings of the War Cabinet, when statements of fact or expressions of opinion have been asked for and obtained from them.

Mr. Billing: May I ask whether members of the Air Service have been called upon?

Mr. Bonar Law: Many times.

No Secret Session.

MR. BONAR LAW, on March 19th, answering Mr. Pemberton Billing, who asked whether, following the decision of the French Government, he would grant a secret Session of the House to be devoted entirely to a discussion of the Air Service, said he did not think there was any advantage in adopting the suggestion or that it would commend itself to the House.

METHODS OF MEASURING AIRCRAFT PERFORMANCES.

By Captain H. T. TIZARD, R.F.C.

(Concluded from page 254.)

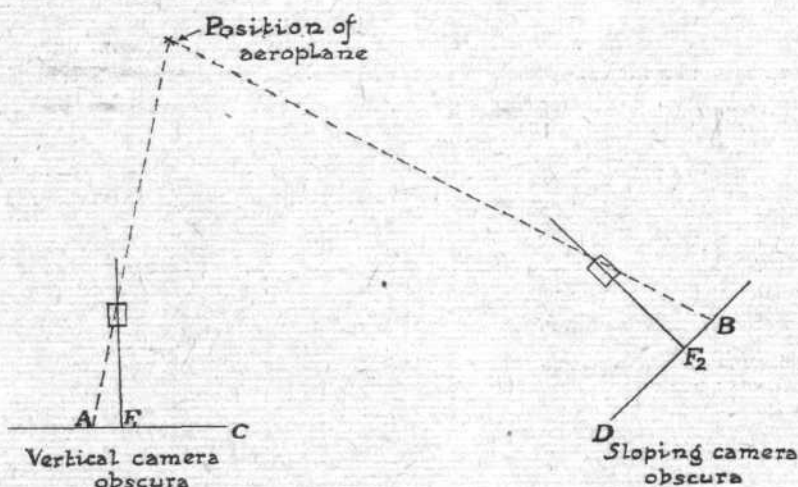
WE must now consider how the true speed of the aeroplane is deduced from the reading of the air speed indicator. It is well known that an air speed indicator reads too low at great heights—for example, if it reads 70 m.p.h. at 8,000 ft. the real speed of the machine through the air is nearer 80 m.p.h. The reason for this is that the indicator, like the aneroid, is only a pressure gauge—a sensitive pressure gauge, in fact, which registers the difference of pressure between the air in a tube with its open end pointing forward along the lines of flight of the machine, and the real pressure (the static pressure) of the external air. This difference of pressure is as nearly as we can judge by experiment $= \frac{1}{2} \rho V^2$ (where ρ is the density of the air and V the speed of the machine), provided that the open end of the tube is well clear of wings, struts, fuselage, &c., and so is not affected by eddies and other disturbances. Now assuming this law, air speed indicators are graduated to read correctly, as I have said above, at a density of 1.221 kgm. per cubic metre, which we have taken as our standard density and called "unity." It corresponds on an average to a height of about 800 ft. above sea level.

Then suppose the real air speed of an aeroplane at a height of " h " feet is V m.p.h., and the indicated air speed is 70 m.p.h., this means that the excess pressure in the tube due to the speed is proportional to 1×70^2 , or $\rho \times V^2 = 1 \times 70^2$, where ρ is the density at the height in question, expressed as a fraction of the standard density. To correct the observed speed, we therefore divide the reading by the square root of

One method is to use two camera obscuras, one of which points vertically upwards and the other is set up sloping towards the vertical camera. At one important testing centre the cameras are a mile apart, and the angle of the sloping camera is 45° . By this arrangement, if an aeroplane is directly over the vertical camera it will be seen in the field of the sloping camera if its height is anywhere between 1,500 and 15,000 ft., although at very great heights it would be too indistinct for measurements except on a very clear day. The height the tests are usually carried out is 4,000 ft to 6,000 ft.

The aeroplane is flown as nearly as possible directly over the vertical camera, and in a direction approximately at right angles to the line joining the two cameras. The pilot flies in as straight a line and at as constant an air speed as he can. Observers in the two cameras dot in the position of the aeroplane every second. A line is drawn on the tables of each camera pointing directly towards the other camera, so that if the image of the aeroplane is seen to cross the lines in the one camera it crosses the line in the other simultaneously. From these observations it is possible to calculate the height of the aeroplane with considerable accuracy; the error can be brought down to less than 1 part in 1,000 with care. Knowing the height, we can then calculate the speed over the ground of the aeroplane by measuring the average distance on the paper passed over per second by the image in the vertical camera. If x ins. is this distance, and f the focal length of the lens, the ground speed is $x \times h/f$ ft. per second.

FIG. 3.

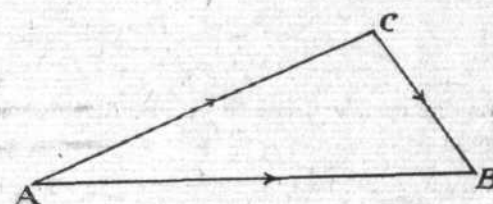


the density. Thus, observation of the maximum speed of an aeroplane at a height of 8,000 ft. by the locked aneroid gave 80 m.p.h. on the indicator, the temperature being 31°F . From the curve we find that the density corresponding to 8,000 ft and 31° is 0.85 of standard density. The corrected air speed is therefore:—

$$= \frac{80}{\sqrt{0.85}} = 86.7 \text{ m.p.h.}$$

This "corrected" air speed will only be true if the above law holds, that is to say, if there are no disturbances due to the pressure head being in close proximity to struts or wings. It is always necessary to find out the magnitude of this possible error, that is, to calculate the air speed meter, and the only way to do this is to measure a real air speed at some reasonable altitude for easy observation of the aeroplane by actual timed observations from the ground, and from these timed results check those deduced from the air speed indicator readings. This calibration is the most important and difficult test of all, since on the accuracy of the results depends the accuracy of all the other speed measurements. It can either be done by speed trials over a speed course close to the ground, or when the aeroplane is flying at a considerable height above the ground. In the Testing Squadron we have always attached much more importance to the latter method, mainly because the conditions approximate more to the conditions of the ordinary air speed measurements at different heights, and because the weather conditions are much steadier and the flyer can devote more attention to flying the machine at a constant air speed than he can when very close to the ground.

FIG. 4.



AB represents the measured speed of the aeroplane on the ground.

CB on the same scale represents the velocity & direction of the wind.

Therefore AC represents the real speed of the aeroplane through the air.

It is necessary to know also the speed and direction of the wind at the height of the test. For this purpose the pilot or his observer fires a smoke puff slightly upwards when over the cameras, and the observer in the vertical camera dots in its trail every second. The height of the smoke puff is assumed to be the same as that of the aeroplane—it probably does not differ from this enough to introduce any appreciable error in the results. The true speed through the air is then found graphically as shown in Fig. 4. Here the length AB represents the ground speed of the aeroplane as measured in the camera, and CB represents on the same scale the velocity and direction of the wind. The length AC represents, also on the same scale, the true air speed of the machine.

The tests are done in any direction relative to the wind, and generally at three air speeds, four runs being made at each air speed.

The advantages of this method are:—

- (1) Being well above the earth the pilot can devote his whole attention to the test.
- (2) Within reasonable limits any height can be chosen, so that it is generally possible to find a height at which the wind is steady.
- (3) It does not matter if the pilot does not fly along a level path so long as he does so approximately. What is more important is that he should fly at a constant air speed.
- (4) It is not necessary that there should be any communication between the two cameras, although it is convenient. The two tracks are made quite independently, and synchron-

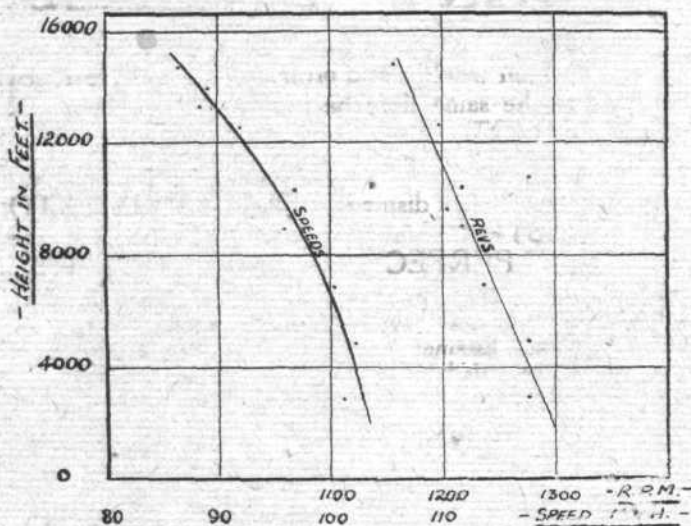
ised afterwards from the knowledge that the image must have passed over the centre line simultaneously in the two cameras.

The main disadvantage is that somewhat elaborate apparatus is necessary, but this is of not much importance in a permanent testing station.

There are often periods in war time, however, when an aeroplane has to be tested quickly, and low cloud layers and other causes prevent the camera test from being carried out. It is then necessary to rely on measurements of speeds near the ground for the calibration of the air speed indicator. In this method the aeroplane is flown about 10 ft. off the ground, and is timed over a measured run. There are two observers,

FIGURE 5—

AIR SPEEDS AT HEIGHTS 27. 12. 16 —



one at each end of the course. When the aeroplane passes the starting point the observer sends a signal and starts his stop-watch simultaneously; the second observer starts his stop-watch directly he hears the signal, and in his turn sends a signal and stops his watch when the aeroplane passes the finishing point. By this double timing errors due to the so-called "reaction time" of the observers are practically eliminated, for the observer at the end of the course tends to start his watch late, while the first observer stops his late. The mean of the two observations gives the real time. Four runs, two each up and down the course, are done at each air speed, the pilot or his observer noting carefully the average air speed during the run. Observations of the atmospheric pressure and temperature from which the density can be obtained are also taken. The average strength and direction of the wind during each trial are noted from a small direct reading (or recording) anemometer and the speed corrected in the same way as in the camera tests. If there is a strong cross wind the aeroplane may have to be pointed at a considerable angle to the course, and this makes the test a very difficult one to carry out well. Generally speaking, it is only reliable when the wind is quite light, not more, at any rate, than 10 m.p.h. Even this is too strong if it is a cross wind.

A further difficulty is that at high speeds, over 100 m.p.h., an aeroplane may take quite a considerable time to accelerate up to a steady speed, and so it must fly level for a long distance each end before reaching the actual course. At the testing station previously alluded to the course is a mile long, and there is a clear half mile or more at each end; but it is doubtful whether even this distance is enough for the machine to attain steady speed before the starting point. Finally, the flyer of a single-seater is generally too busy watching the ground to do more than glance at his air speed indicator more than a few times during the run. Doubtless it would be better in such a case to use some form of recording air speed instrument, although then other difficulties would arise.

Having got the true air speed from camera or speed course tests, and knowing the density at the height at which the test was carried out, we obtain what the air speed indicator should have read by multiplying the measured air speed by the square root of the density. By comparing this with the actual reading of the indicator we obtain the necessary correction. The whole procedure may be shown best by a table giving part of the results of a camera test made at the beginning of the year.

TABLE V.—Calibration Test of Air Speed Indicator No. on Machine. Date December 24th, 1916.

Run No.	Measured ground speed.	Measured wind speed and direction.	Corrected true (= V) air speed	Observed Aneroid height.	Observed temp.	Density (= ρ) referred to standard density.	Observed air speed.	$V \times \sqrt{\rho}$.	Correction necessary.
1	59	31.0	161.5	89.2	5,100	31	0.879	80.0	83.6 x 3.6
2	59	28.6	5.5	93.7	5,100	31	0.879	85.0	87.8 x 2.8
3	123.4	32.3	168.5	93.8	5,050	31	0.881	85.0	88.1 x 3.1
4	62.0	32.3	21.0	95.6	5,000	31	0.882	86.0	88.8 x 2.8
	124.7								Mean x 3.1

FIGURE 6—

AIR SPEEDS AT HEIGHTS 9. 12. 16 —

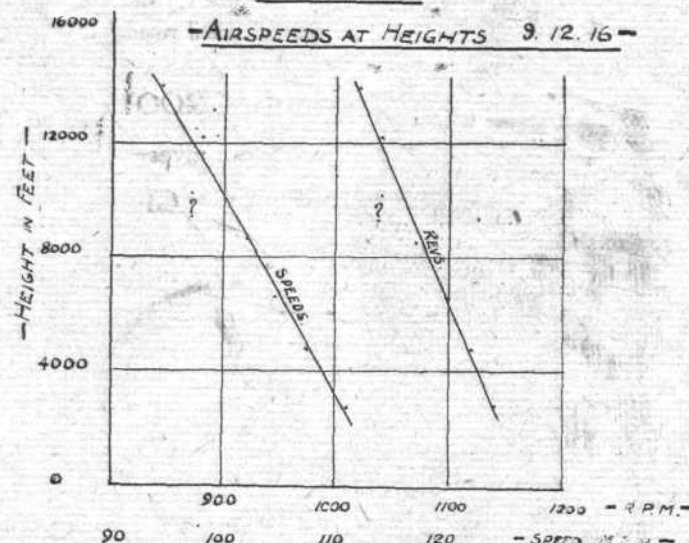


TABLE VI.—Air Speeds at Heights. December 27th, 1916.

Aneroid height.	Temp. observed.	Standard density.	Corresponding standard height.	Observed air speed (m.p.h.).	Corr. for calibration tests.	Corr. for density.	Observed r.p.m.	Final results from curve.	Air speed (m.p.h.).	r.p.m.
3,000	39	.935	2,900	95	98	101½	1,280	3,000	103.0	1,290
5,000	35	.875	4,900	93	96	102½	1,280	6,500	100.5	1,250
7,000	30	.821	6,900	88	91	100½	1,240	10,000	96.5	1,215
9,200	24	.767	9,000	81	84	96	1,220	13,000	94.5	1,180
10,800	19	.731	10,400	80	83	97	1,220	15,000	86.0	1,160
12,800	17	.682	12,600	72	76	92	1,200			
13,800	12	.664	13,400	68	72	88½	1,180			
15,200	8	.636	14,800	65	69	86½	1,160			

A summary of the complete speed tests may now be given. Firstly, the air speed and engine revolutions are noted flying level at full throttle every 2,000 ft. approximately by aneroid. From the aneroid reading and temperature observation at each height the density is obtained. The reading of the air speed indicator is then first corrected for instrumental errors by adding or subtracting the correction found by calibration tests over the cameras or speed course. This number is then again corrected for height by dividing by the square root of the density. The result should give the true air speed, subject of course, to errors of observation. The numbers so obtained are plotted against the "standard" heights, i.e., the average height in feet corresponding to the density during the test. A smooth curve is then drawn through the points and the air speeds at standard heights of 3,000, 6,500, 10,000, 13,000 and 16,500 read off the curve. These heights are chosen because they correspond closely with 1, 2, 3, &c., kilometres. The indicated engine revolutions are also plotted against the standard heights, because these observations form a check on the reliability of the results; also the ratio of speed to engine revolutions at different heights may give valuable information with regard to the propeller.

Table VI gives complete results of one of our tests of air speed at heights. The table refers to the same machine as Table V, which gives the results of calibration tests of the air speed indicator. Fig. 5 shows the smooth curve drawn from the calculated data, the actual air speeds calculated from the observations being shown by dots, while the observed engine revolutions at the same heights are marked in by dots. Fig. 6

gives another example, where the observations were very good; the air speeds and revolutions per minute lie very closely on a smooth curve except at one point (about 10,000 ft.), where they were probably affected by a downward current of air.

In a brief paper it is impossible to do more than explain the more important of the "performance" tests of aeroplanes, considered solely as flying machines. For military purposes a number of tests are necessary, some of which cannot easily be reduced to figures. Nor can it be supposed for an instant that the methods outlined here are final. Aeroplane testing, like all other work connected with aeroplanes, is only in its infancy; and as time goes on, and knowledge accumulates, better methods and instruments will be evolved. There are some who lay considerable emphasis on the necessity of every test instrument being self-recording, and although this scheme appears at first sight Utopian and would relieve the pilot of a single-seater of considerable trouble, there are many objections to it when considered in detail, not the least of which is the difficulty of getting new and elaborate instruments made at a time when all manufacturers are fully engaged on other important work. When an observer can be taken I would personally place much more reliance on direct observations at the present time, and one great advantage of direct observations is that the results are *there*, and no time is lost through the failure of a recording instrument to record, a circumstance which is not unknown in practice. So far as we use recording instruments, we use them only as a check on direct observations, although we shall probably soon adopt recording air speed indicators for the calibration tests. But whether recording or direct reading instruments are used, it is, as I said before, the flyer on whom the accuracy of the tests depends. I feel that too great stress cannot be laid on this; he is the man who does most of the experiments, and like all experimenters in every branch of science, he requires training and a great deal of practice. Although the methods themselves may be greatly changed, this much may perhaps be claimed, that the general principles on which they are founded are sound, and will only be altered in detail. The importance of the work can hardly be exaggerated; model experiments are notoriously subject to scale and other corrections, which, if not carefully scrutinised, may be very misleading, and it is only by accurate full scale work that we can hope to maintain a steady improvement in the efficiency of aeroplanes.

DISCUSSION.

During the discussion that followed several interesting points were raised, and the opinions expressed could, generally speaking, be divided into two groups—those in favour of employing recording instruments and those who preferred to rely on the observations of skilled test pilots.

Capt. Farren expressed himself in the main in agreement with the lecturer, but said that he thought it possible to maintain a horizontal flight path with the aid of the aneroid, as he knew pilots who could fly for 10 minutes without the aneroid showing any deviation. He expressed regret that the lecturer should have referred to the instrument indicating the rate of climb as the climb-meter, as it was known among pilots as the "Coffeometer." He agreed with the lecturer that reliable testing should preferably be done by men who had some experience in other kinds of scientific tests, and thought that care was really of more value than great skill in flying. His experience had been that it was difficult to make pilots see that it was necessary during altitude tests to go an odd thousand feet higher than shown by the aneroid, and

that the only way to get the pilots to go to 18,000 ft. corrected height was to tell them that they were required to go to 20,000 ft. by the aneroid.

Capt. Grinstead was of the opinion that further progress would largely depend on improvement in instruments. At present, he said, it appeared that the only two phases of a machine's performance that were measured were speed and climb, and he expressed the belief that before long instruments would be needed which would indicate how long a machine took to turn through a given angle—in other words, some measure of a machine's manœuvring power.

Major Fowler pointed out the importance of standardisation on a basis of density, and expressed the hope that the data relating to these tests might be communicated to designers and manufacturers. Although thermometers were old friends of his, he had never yet met one without lag, and asked what the experience of the lecturer had been in this respect. He admitted that recording instruments still required great improvements, but thought progress would lie along lines of improved instruments, as it was really asking too much of a pilot to expect him to handle the machine and, at the same time, read a thermometer, aneroid, speed indicator, revolutions indicator and statoscope.

Squadron-Commander Busted thought that very often much valuable time might be saved by not relying too much on instruments. He said that his experience had been that if you were waiting for instruments the weather was generally fine, and by the time the instruments arrived the weather had changed, necessitating further delay. When suitable weather came it was often found that something was adrift with the delicate instruments, and personally he believed in getting the job done quickly, if necessary by observation rather than trusting to instruments.

Lieut. A. R. Low was in favour of recording instruments, and advanced the interesting theory, based on personal experience as an observer, that every machine had its period of oscillation, and that if this period coincided with the time taken in "making the round" of all the various instruments misleading results might be obtained.

Mr. B. Cooper asked whether it had not been found that there was a lag in the climb-meter, due to accumulated pressure in flask.

Lieut. Miller thought that the standard atmosphere, instead of being empirical, should be on a mathematical basis, which gave sufficiently accurate results. He did not like the expression "true air speed," as no one ever used the term "true water speed" regarding a ship. He suggested "aero-speed" for corrected speed.

Mr. Bairstow expressed surprise at the lecturer's statement that model experiments might, under certain conditions, be very misleading. He said that in no instance had the error between model and full-size experiments been found to exceed 10 per cent.

Capt. Tizard, in reply, said that he had found that lag in aneroids was less than expected, due probably to the fact that the instrument was subject to vibration. The lag in thermometers had not been found to be appreciable, but the lag in the climb-meter was rather more serious. By descending in stages of 2,000 ft. and then flying level for some time, this drawback could, however, be largely remedied. Gyroscopic control had, he said, not been tried for test purposes. In regard to model experiments he did not in any way underestimate the value of these, but, as so much depended on engines and propellers, errors were bound to occur, and other factors affected the performance of a machine, as, for instance, the consumption of fuel during a climb.

AEROPLANES IN THE ADVANCE.

Writing from the British Headquarters, Mr. Philip Gibbs, in his pen-picture of the big advance round Bapaume, gives the following glimpses of the work of the R.F.C. :—

"An aeroplane had crashed to earth in the shell-blasted fields, and it was one of ours. A car came along, and I saw a young pilot lying back wounded, with another officer smoking a cigarette, but grave-eyed and white. A little farther on I saw the fallen aeroplane. Pools of red mud were on each side of the road and in the middle of it. . . .

"Flights of British aeroplanes were up and singing with a loud, deep humming music, as of monstrous bees. Our Archies were strafing a German plane, venturesome over our country. High up in the blue was the rattle of machine-gun fire. . . .

"Our cavalry patrols are over the hills and far away. Our infantry patrols are pushing forward into new territory, so that only aeroplanes know the exact whereabouts. As one

aviator has just reported: 'Our men are lighting fires and taking their dinners at places off the map.' They are going into pubs which have been burnt out to find beer which is not there. North and east of Bapaume our patrols have gone beyond the villages of Rocquenes, Bancourt, Favreuil and Sapignies. . . .

"Much farther south, in the neighbourhood of Nesle, French and British cavalry patrols came into touch to-day, and one of our aviators reports that he saw French civilians waving flags and cheering them.

"The Germans have a cavalry screen behind their rear-guards. They were seen yesterday north of Bapaume and southwards beyond Roye. And some of them were chased by a British airman at a place called Ennemain. He swooped low like an albatross, and brought a man off his horse by a machine-gun bullet. Others stampeded from this terrible bird."

The British Air Service

"PER ARDUA AD ASTRA"

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, it is not repeated in this column.

Royal Naval Air Service.

Admiralty, March 13th.

J. R. Erskine Murray, D.Sc., F.R.S.E., granted temp. commission as Lieut. R.N.V.R., with seniority Mar. 10th.

S. J. Smith, P. Westcott, W. M. Jones, M.Sc., and Profr. P. G. Gundry granted temp. commissions as Lieuts. R.N.V.R., and appointed to "President," additional, for R.N.A.S., all to date Mar. 12th.

C. G. Lindlay granted temp. commission as Sub-Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., to date Mar. 10th.

The following entered as temp. prob. Flight Officers and appointed to "President," additional, for R.N.A.S., to date as stated: A. S. Girding, M. W. Baseden, C. H. Whitehouse, Major H. Bailey, L. E. Swann, L. L. King, C. Y. Capes, N. T. Thorne, F. H. R. Slowburn, J. W. C. Reynell, L. C. Hill, W. F. Cleeve, G. Davies, W. Igleston, E. M. Knott, W. R. D. Pandon, J. C. F. Simpson, G. Slater, and E. A. Mossop; Mar. 18th. H. J. Emery (prob.); Mar. 8th.

E. Selley promoted to Temp. Warrant Officer, 2nd grade, and appointed to "President," additional, for R.N.A.S., to date Mar. 10th.

Admiralty, March 19th.

Lieut. H. S. Holroyd, entered as Prob. Flight Officer, for temp. service, to date Mar. 25th.

The following granted temp. commissions as Lieut., R.N.V.R., all with seniority Mar. 17th: A. McD. Steele, V. Finigan, B. V. Roche and G. W. Wildman.

The following granted temp. commissions as Sub-Lieut., R.N.V.R., all with seniority Mar. 17th: Prob. Flight Sub-Lieut. A. E. Horn, and late Temp. Prob. Flight Officers: J. R. Attwell, D. I. Davies, E. W. Unmack, R. W. Greenwood, W. L. Hill Pattison, S. T. Butteris and F. B. Pelly.

Royal Flying Corps (Military Wing).

London Gazette Supplement, March 12th.

Flight-Commander.—Lieut. G. C. O. Osborne, Can. Machine Gun Serv., from a Flying Officer, and to be Temp. Capt. whilst so employed; Feb. 1st.

Depot Commander.—Temp. Major F. R. G. Hoare, Army Ord. Dept., to be transfd. to Gen. List, and to be Temp. Lieut.-Col. whilst so employed; Jan. 1st.

Equipment Officers, 1st Class.—Temp. Lieut. R. C. Lane, Gen. List, from Adj., and to be Temp. Capt. whilst so employed; Feb. 15th.

3rd Class.—Lieut. A. H. Fynn, S. Ian. R. (T.F.), and to be sec'd.; Feb. 22nd.

London Gazette, March 13th.

Balloon Commander (graded as a Balloon Officer).—Temp. 2nd Lieut. R. B. Wann, Gen. List, from a Balloon Officer, and to be Temp. Lieut. whilst so employed; Jan. 20th.

Adjutant.—Capt. H. P. D. Helm, Bord. R., S.R., from a Flying Officer (Ob.), vice Capt. G. B. Fraser, King Edward's Horse, S.R.; Feb. 13th.

Equipment Officers, 2nd Class.—From the 3rd Cl., and to be Temp. Lieuts. whilst so employed; Feb. 6th: 2nd Lieut. T. McL. Mackay, S.R.; 2nd Lieut. J. Pearce, K.O. Sco. Bord.

Group Instructors in Gunnery (graded as Flight-Commanders).—Jan. 10th: Capt. M. G. B. Copeman, Leic. R., a Flight-Comdr., from a Wing Instr. in Gunnery (graded as a Flight-Comdr.); Lieut. (Temp. Capt.) S. H. B. Harris, S.R., a Flight-Comdr., and to retain his temp. rank whilst so employed. From Wing Instrs. in Gunnery (graded as Flight-Comdrs.).—2nd Lieut. (Temp. Capt.) W. G. B. McKechnie, R. Sc. Fus., a Flying Officer, and to retain his temp. rank whilst so employed; Jan. 10th. Capt. J. H. C. Minchin, Sco. Rif., a Flight-Comdr., vice 2nd Lieut. (Temp. Capt.) W. G. B. McKechnie, R. Sc. Fus.; Jan. 17th. 2nd Lieut. (Temp. Capt.) R. G. Heyn, S.R., a Flying Officer, and to retain his temp. rank whilst so employed, vice Capt. M. G. B. Copeman, Leic. R.; Feb. 17th.

Group Instructor in Gunnery (graded as an Equipment Officer, 1st Class).—Capt. D. E. Ward, Lond. R. (T.F.), and to be sec'd., vice Lieut. (Temp. Capt.) S. H. B. Harris, S.R.; Feb. 17th.

Wing Instructors in Gunnery (graded as Flight-Commanders).—Jan. 10th: Capt. J. H. C. Minchin, Sco. Rif., a Flight-Comdr. And to be Temp. Capts. whilst so employed: Flying Officers.—2nd Lieut. A. P. Davidson, High. L.I.; 2nd Lieut. H. J. Brewster, Middx. R., vice Capt. J. H. C. Minchin, Sco. Rif.; Jan. 17th. Feb. 3rd: Temp. Capt. C. O. F. Modin, Gen. List, a Flying Officer. And to be Temp. Capts. whilst so employed: Flying Officers.—Temp. 2nd Lieut. A. R. C. Cooper, Gen. List; 2nd Lieut. C. H. Stokes, S.R. 2nd Lieut. A. P. Hartley, Ches. R. (T.F.); Feb. 6th. Temp. Lieut. P. A. Moodie, Gen. List, vice 2nd Lieut. (Temp. Capt.) P. G. Heyn, S.R.; Feb. 17th.

Wing Instructors in Gunnery (graded as Equipment Officers, 1st Class) and to be Temp. Capts. whilst so employed.—2nd Lieut. (Temp. Lieut.) A. C. Bishop, Yeo. (T.F.), from an Equipment Officer, 3rd Cl.; Nov. 14th. 2nd Lieut. W. C. Lambert, Yeo. (T.F.), and to be sec'd.; Jan. 10th.

Central Flying School.

Instructors.—Capt. A. C. Clarke, Welsh R., a Flight-Comdr., vice Lieut. (Temp. Capt.) A. M. Wilkinson, D.S.O., Hamps. R. (T.F.); Jan. 12th. 2nd Lieut. (Temp. Capt.) T. Davidson, Cann. Highrs. (T.F.), a Flight Comdr., vice Capt. (Temp. Maj.) H. R. Nicholl, S.R.; Feb. 10th.

School of Aerial Gunnery.

Commandant (graded as a Depot Commander).—Lieut. (Temp. Major) H. E. Chaney, Lan. Fus., from a Chief Instr. (graded as a Park Comdr.), and to be Temp. Lieut.-Col. whilst so employed; Feb. 6th.

Instructors (graded as Equipment Officers, 1st Class).—Feb. 6th: 2nd Lieut. (Temp. Capt.) A. J. G. Anderson, Lond. R. (T.F.), and to retain his temp. rank whilst so employed: Temp. Lieut. H. Cockerell, Gen. List, from an Asst. Instr. and to be Temp. Capt. whilst so employed.

Assistant Instructors (graded as Equipment Officers, 2nd Class).—Feb. 6th: Lieut. F. R. Allford, M.C., Canadian Mach. Gun Serv.; Lieut. G. H. J. Mercer, D. of Corn. L.I., and to be sec'd.; Lieut. J. N. H. Brooke, Lpool. R. (T.F.), from Mach. Gun Corps. And to be Temp. Lieuts. whilst so employed: 2nd Lieut. (on prob.) J. A. Cooper, Yeo. (T.F.), and to be sec'd.; Temp. 2nd Lieut. C. P. H. Gunyon, Gen. List, an Equipment Officer, 3rd Cl.; Temp. 2nd Lieut. H. F. Alton, Gen. List, a Flying Officer (Ob.); Temp. 2nd Lieut. J. H. Gaudion, Durh. L.I., and to be transfd. to the Gen. List.

Memorandum.—Sergt. J. Hooper from R.F.C. to be Temp. 2nd Lieut. (on prob.) for duty with the military wing of that Corps; Jan. 27th.

London Gazette Supplement, March 14th.

The undermentioned to be Temp. 2nd Lieuts.:—For duty with Royal Flying Corps.—Lce.-Corpl. H. Harris, from Can. Engrs.; Jan. 4th. Corpl. E. J. Hare, from S. African Sig. Co.; Feb. 12th. Sergt. R. N. L. Munro, from R.F.C.; Feb. 16th.

Flight Commander.—2nd Lieut. K. L. Caldwell, S.R., from a Flying Officer, and to be Temp. Capt. whilst so employed; Feb. 22nd.

Balloon Company Commander (graded as a Flight Commander).—Temp. Lieut. I. P. H. Preston, Gen. List, from a Balloon Officer, and to be Temp. Capt. whilst so employed; Feb. 20th.

Flying Officer.—Temp. Lieut. S. Stretton, Gen. List, from a Flying Officer (Ob.); Feb. 17th, with seniority from Mar. 16th, 1916.

Balloon Officers.—Lieut. (Temp. Capt.) G. H. Green, R. Scots (T.F.), and to be sec'd.; Feb. 12th. Lieut. (Temp. Capt.) A. H. C. Hope, Sea. Highrs. (T.F.), and to be sec'd.; Feb. 21st, with seniority from May 23rd. Lieut. J. P. Walters, R. Dub. Fus., and to be sec'd.; Feb. 21st. 2nd Lieut. B. G. L. Ellis, R. Guernsey Art. and Engrs. Mila. from Temp. 2nd Lieut. R.A., Feb. 21st, with seniority from June 16th. 2nd Lieut. H. A. Edridge-Green, R. W. Fus., and to be sec'd.; Feb. 21st. Capt. H. A. Page, S. Staff. R. (T.F.), and to be sec'd.; Feb. 25th, with seniority from May 23rd. Capt. R. L. S. Raffles, R. W. Fus., S.R., reverts from a Balloon Co. Comdr. (graded as a Flight-Comdr.) to a Balloon Officer, at his own request; Feb. 20th, with seniority from Nov. 5th, 1915. (Substituted for the notification in the Gazette of Feb. 26th.) Capt. S. C. Raffles, 3rd R.-W. Fus., S.R., reverts from a Balloon Co. Comdr. (graded as a Flight-Comdr.) to a Balloon Officer, at his own request; Feb. 10th, with seniority from Sept. 5th, 1915.

Equipment Officers, 1st Class.—To be transfd. to Gen. List and Temp. Capts. whilst so employed. Jan. 1st: Temp. Lieut. W. H. Ewen, Army Ord. Dept.; Temp. Lieut. G. Elliott-Lockhart, Army Ord. Dept.

3rd Class.—Lieut. L. E. Palmer, York and Lanc. R., and to be sec'd.; Jan. 1st. 2nd Lieut. (on prob.) A. C. Truelove, S.R.; Feb. 15th. Feb. 17th: Temp. 2nd Lieut. A. L. Hyslop, Gen. List; Temp. 2nd Lieut. A. E. Gay, Gen. List; Temp. 2nd Lieut. F. A. W. Braine, Gen. List.

Schools of Military Aeronautics.

Chief Instructor (graded as a Squadron Commander).—Temp. Capt. C. E. I. C. Anne, Gen. List, from a Flight-Comdr., and to be Temp. Major whilst so employed, from Sept. 19th to Oct. 31st.

Assistant Instructor (graded as an Equipment Officer, 2nd Class).—The appt. of 2nd Lieut. (Temp. Lieut.) A. C. Bishop, Berks. Yeo. (T.F.), notified in the Gazette of Feb. 8th, is cancelled.

Memoranda.—2nd Lieut. R. R. Prentice, R.F.C., S.R., to be Temp. Capt. whilst specially employed; March 15th. Corpl. F. A. W. Braine, from R.F.C., to be Temp. 2nd Lieut. for duty with the Mil. Wing of that Corps; Jan. 30th. The undermentioned to be Temp. 2nd Lieuts. (on prob.), for duty with R.F.C.: A. E. Abell; Mar. 3rd. L. O. Millington; Mar. 9th.

Supplementary to Regular Corps.—The Christian names of 2nd Lieut. (on prob.) Bernhard Owen Watts are as now described. The notification in the Gazette of Oct. 3rd, of the appt. as 2nd Lieut. (on prob.) of R. Berl is cancelled. The undermentioned 2nd Lieuts. (on prob.) are confirmed in their rank: E. C. Deeth, S. F. Brown, G. E. P. Elder, P. S. Leigh, J. E. J. Crawford, A. S. Windsor, J. W. Parkinson, F. Ryder, J. M. Fumival. The undermentioned to be 2nd Lieuts. (on prob.): J. H. Ledebor; Dec. 14th. R. O. King; Feb. 25th.

London Gazette Supplement, March 15th.

Temporary appointments at War Office:—

Staff Captain.—Lieut. (Temp. Capt.) D. B. Sanders, R.F.C., S.R., from an Equipment Officer, 1st Cl., and to retain his temp. rank whilst so employed, vice Temp. Capt. C. M. Smith, M.C., Gen. List; Feb. 26th.

Staff Lieutenant.—2nd Lieut. (Temp. Lieut.) J. B. Sidebotham, R.E. (T.F.), and to retain his temp. rank whilst so employed, vice Lieut. (Dist. Officer) C. Mason, R.A.; Dec. 14th.

Flying Officer.—Temp. Lieut. T. L. W. Stallibrass, Gen. List, from a Flying Officer (Ob.); Feb. 15th, with seniority from Dec. 19th, 1915.

Equipment Officers, 1st Class.—Dec. 14th: Temp. Major J. Goodman, Gen. List; Temp. Capt. C. P. White, Gen. List; Capt. A. G. Shortt, Ret. List; and to be Temp. Capts. whilst so employed: Lieut. (D.O.) C. Mason, R.A., and to be sec'd.; Temp. Lieut. T. M. Rogers, Gen. List, from the 2nd Cl.; 2nd Lieut. G. Ralston, S.R., from the 3rd Cl.; 2nd Lieut. J. G. Hope, S.R., from the 3rd Cl.; 2nd Lieut. D. MacK. P. Riach, S.R., from the 3rd Cl. Temp. Lieut. A. H. W. Skitt, Army Ord. Dept., and to be transfd. to Gen. List; Jan. 1st.

2nd Class.—Dec. 14th: 2nd Lieut. (Temp. Capt.) C. F. Cape, Yeo. (T.F.), and to retain his temp. rank whilst so employed; Lieut. W. E. Grey, Lond. R. (T.F.), and to be sec'd. And to be Temp. Lieuts. whilst so employed: Temp. 2nd Lieut. E. R. Atkinson, Gen. List, from a Flying Officer; 2nd Lieut. G. Dennison, S.R., from the 3rd Cl.; 2nd Lieut. W. Burnside, Arg. and Sutthd. Highrs., S.R., and to be sec'd. From the 3rd Cl., and to be Temp. Lieuts. whilst so employed: 2nd Lieut. C. L. Hardy, S.R.; 2nd Lieut. S. H. Hawes, S.R.; 2nd Lieut. G. F. Harmer, S.R.; Temp. 2nd Lieut. J. M. Macaulay, Gen. List; 2nd Lieut. J. T. Rossiter, S.R.; 2nd Lieut. H. L. U. Clark, S.R.; 2nd Lieut. A. G. Griggs, S.R.; 2nd Lieut. F. A. Woolfe, S.R. Lieut. H. W. Young, Lond. R. (T.F.); Jan. 1st. Temp. Lieut. R. W. Patterson, R.E.; Jan. 16th.

Memoranda.—Lce.-Corpl. W. G. M. Nicholl, from A.S.C., to be Temp. 2nd Lieut. for duty with R.F.C.; Oct. 27th, 1915. (Substituted for the notification in the Gazette of Nov. 22nd, 1915.) A. H. Sippe to be Temp. 2nd Lieut. (on prob.) for duty with R.F.C.; Mar. 9th.

London Gazette, March 16th.

Flight Commander.—Lieut. R. H. Cronyn, S.R., from a Flying Officer, and to be Temp. Capt. whilst so employed; Mar. 4th.

Flying Officers.—Temp. 2nd Lieut. D. Lindley, S. Wales Bord., and to be transfd. to Gen. List; Feb. 26th. Feb. 27th: Major J. A. Milot, Canadian Gen. List; Lieut. S. McKercher, Canadian Inf. Bn.; Feb. 28th: Temp. 2nd Lieut. D. R. C. Lloyd, N. Lan. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. E. Kent, Essex R.; 2nd Lieut. (on prob.) G. E. P. Elder, S.R.

Balloon Officers.—2nd Lieut. A. Barker, Unatt'd. List, Ind. Army; Jan. 31st. Feb. 21st: 2nd Lieut. (Temp. Lieut.) C. B. Waters, Lond. R. (T.F.), and to be sec'd.; Temp. 2nd Lieut. S. N. Veitch, Gen. List, from an Equipment Officer, 3rd Cl.; 2nd Lieut. D. W. Lamb, Lond. R. (T.F.), and to be sec'd.; 2nd Lieut. (on prob.) J. G. Sharp, R.G.A., S.R.; Temp. 2nd Lieut. (on prob.) A. L. Baker, Gen. List. Temp. 2nd Lieut. W. M. Edwards, Gen. List; Feb. 23rd.

Equipment Officers, 1st Class.—2nd Lieut. (Temp. Lieut.) H. A. Browne, S.R., from the 2nd Class, and to be Temp. Capt. whilst so employed; Feb. 22nd. 2nd Class.—Lieut. (Temp. Capt.) A. M. Cott, S.R., reverts from Equipment Officer, 1st Cl., and relinquishes his temp. rank; Dec. 26th.

Supplementary to Regular Corps.—2nd Lieut. N. Greenwell relinquishes his commn. on account of ill-health, and is granted the hon. rank of 2nd Lieut.; Mar. 17th. The date of the appt. as 2nd Lieut. (on prob.) of H. B. Lilley is Dec. 13th, and not as in the Gazette of Jan. 12th.

"X" AIRCRAFT RAIDS.

"X 56" Raid (March 16th).

THE following *communiqué* was issued by the Field-Marshal Commanding-in-Chief, Home Forces, at 11 a.m. on March 16th:—

"At 5.30 a.m. to-day a hostile aeroplane dropped some bombs at Westgate. There were no casualties and the material damage caused was slight."

German Version. *Berlin, March 17th.*

"On Friday morning one of our naval aeroplanes successfully dropped bombs on the railway station and sheds at Margate. Two large fires were observed from the aeroplane."

"X 57" Raid (March 16th-17th).

THE following *communiqué* was issued by the Field-Marshal Commanding-in-Chief, Home Force, at 12.20 a.m. on March 17th:—

"Hostile airships attacked the South-Eastern Counties last night. Bombs have been dropped in the county of Kent. The raid is still in progress, and a further *communiqué* will be issued in the morning."

Replying in the House of Commons on March 19th to Mr. Billing, who asked why the Commander-in-Chief of the Home Forces failed to comply with his own announcement that he would issue a second *communiqué* on the Zeppelin raid of last Friday night,

Mr. Macpherson said: There was and is nothing to add to the information which had been given in the communication. No lives were lost and practically no damage was done. In the circumstances the Field-Marshal decided that a second

communiqué was unnecessary, a course with which I am sure the House will agree. ("No, no.")

Sir H. Dalziel asked whether, when a definite announcement was made that a further *communiqué* would be forthcoming, it would not be right and proper to say that there was no further information.

Mr. Macpherson was understood to say that the matter would be considered.

German Version. *Berlin, March 17th.*

"One of our naval airship squadrons, in spite of violent counter-attacks by hostile airmen and anti-aircraft guns, successfully dropped bombs on London and the South-Eastern Counties during an attack lasting half an hour. The airships all returned safely, with the exception of 'L 39,' which, according to French reports, was shot down by French anti-aircraft guns near Compiègne, to the north-east of Paris, at an altitude of 3,500 metres (about 2 miles)."

The telegram adds the following details, which it declares are from an authoritative source: "The airships observed no less than fifty to sixty searchlights within the London area. By the aid of these lights they were hotly but fruitlessly bombarded with incendiary projectiles. Hostile airmen also took part in the attacks on the airships, without, however, succeeding in approaching them. The Thames could be distinctly seen, and also London, although the lights were darkened. During the journey back a heavy storm arose. The airships were vainly sought for by the searchlights of the Thames defences and by the British outposts."

French Bring Down "L 39."

THE following *communiqué* was issued in Paris on March 17th:—

"This morning at about 5.30 Zeppelin 'L 39,' which had flown over the region of Paris, was hit at a height of 3,500 metres by our anti-aircraft guns above Compiègne. 'L 39' fell in flames in the town gardens. Neither the fall of the airship nor the explosion of her bombs did any damage. All the members of the crew of the ship perished."

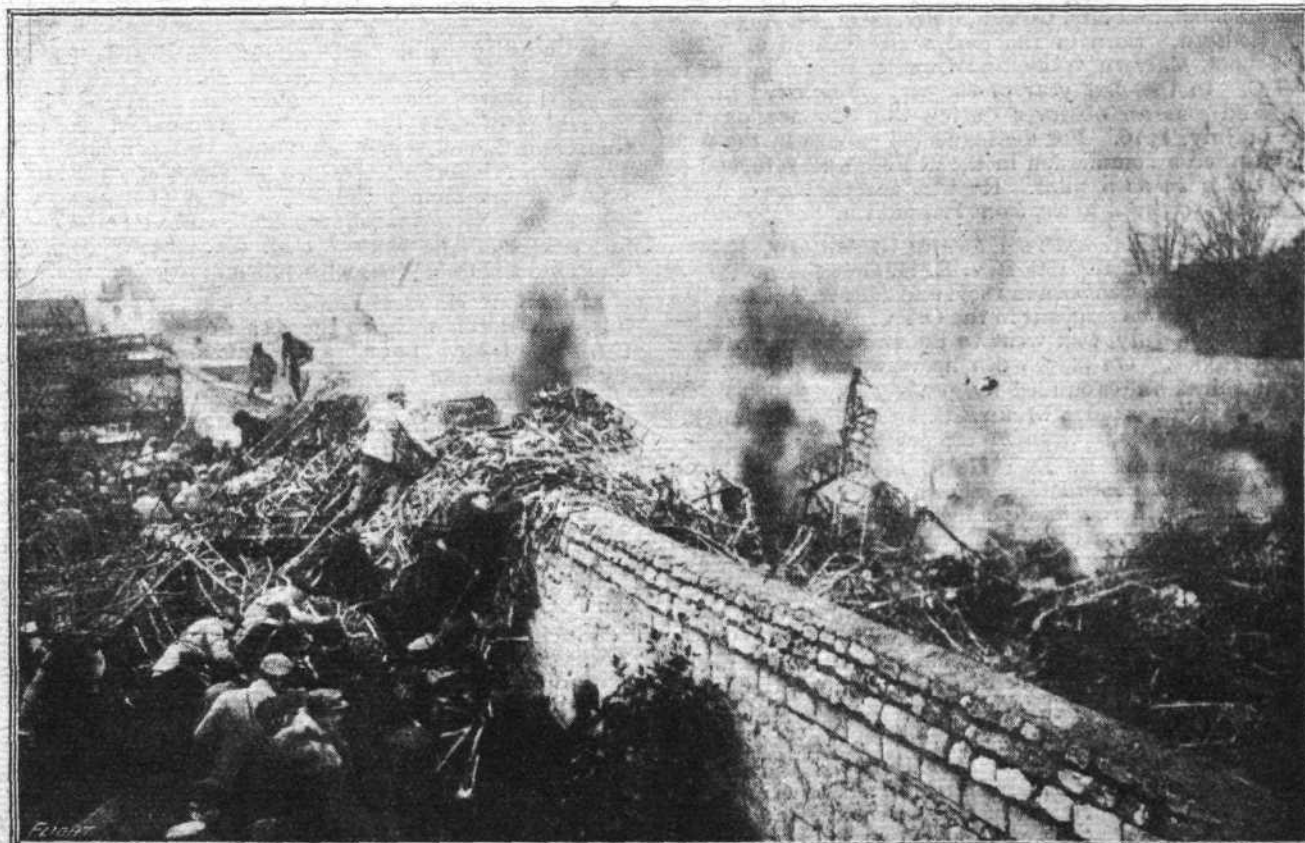
The Raid on Salonica Hospitals.

THE Anglo-Saxon hospitals at Vertekop, which were bombed on March 12th by a German air squadron, with the result that patients and members of the staff, including two British sisters, lost their lives, are well removed from any

military camp, and bore clearly visible the Red Cross emblem. The hospitals were bombed on two or three occasions some months ago, and protests were addressed to the Bulgarian Government, which was informed that there were only hospitals in this position. By way of reprisal British airmen bombed the German aviation camps at Hudova, whither the German air squadron returned after the raid.

Germany and Standardisation.

THERE is reason to believe, says Mr. Leonard Spray, writing to the *Daily Telegraph* from Rotterdam, that tremendous efforts have been concentrated on increasing the flying material. By a system of standardising of parts, an enormous number of machines have been turned out. And, whatever the proportion may be of the available stocks, a very large number has lately been taken to the Western front.



The remains of "L. 39," one of the Zeppelins which took part in the recent raid on Kent, and which was brought down by a French anti-aircraft gunner, the airship falling in flames at Compiègne. The above photograph was secured at 6 a.m. on Saturday (March 17th), before the military had taken charge of the wreckage.

Personals

Casualties.

Flight Sub-Lieutenant R. BIRKS, R.N., killed whilst flying, was the son of Mr. J. Birks, of Brudenell Road, Leeds. He was formerly an officer of the British India Steam Navigation Company, and left India to take up his commission.

Second Lieutenant ARCHIBALD DOUGLAS, R.F.A., att'd. R.F.C. (reported missing on October 16th, now reported killed on that date), was a son of Captain R. Langton Douglas, Director of the National Gallery of Ireland, who is now a Staff Captain at the War Office. He was educated at Tonbridge School, where he was in the first fifteen, and was senior Cadet officer of the O.T.C. In 1914 he won an open scholarship at Trinity College, Oxford, but, as he was only 17 years of age when war was declared, he remained in his School Cadet Corps, and in June, 1915, he was given a commission in the R.F.A. He proceeded to France in November, 1915, and in June of the following year he joined the R.F.C., becoming a qualified observer two months later. On October 16th of last year he was engaged in a reconnaissance above the German lines, when his machine was brought to the ground as the result of anti-aircraft fire. His eldest brother, Major W. S. Douglas, M.C., commands a squadron in the Flying Corps, which is now at the front, and his other brother, Second Lieutenant R. O. Douglas is serving in the West Kent Regiment.

Lieutenant W. SUTTON GARDNER, R.F.A., attached R.F.C., killed in an aerial combat, aged 19, was the only son of Mr. and Mrs. Sutton Gardner, of Laurel House, Cheltenham. He was educated at Cheltenham Grammar School and the Dean Close Memorial School, and was a keen member of the O.T.C. He abandoned a University medical career, after passing his Cambridge entrance examination, to enter the R.M.A., Woolwich, in February, 1916, and after receiving his commission in the R.F.A. he responded to a War Office appeal for volunteers as observation officers for the R.F.C. He went abroad early in December with his squadron, of which he was the intelligence officer. His machine was shot down on March 6th, both observer and pilot being killed.

Second Lieutenant GERALD MAURICE GOSSET-BIBBY, R.F.C., who was killed on March 6th, was the only son of the Rev. A. G. Gosset-Bibby, late headmaster of Kimbolton Grammar School, and Mrs. Gosset-Bibby, of 11, St. Augustine Road, Bedford. Born in 1897, he was educated at Wells House School, Malvern Wells, and Oundle, where he was in the O.T.C. In the first year of the war he enlisted in the R.F.C., and was an observer during the advance on the Somme in July, 1916. For distinguished service in the field he was granted a commission in the R.F.C., and returned to England to train as a pilot. He was gazetted as a flying officer and was ordered to the front last month.

Second Lieutenant DENNIS EDWARD GREENHOW, R.F.C., killed, younger son of the late Rev. E. H. Greenhow, vicar of Chideock, Bridport, was born in 1897, and educated at Lancing College, where he was sergeant in the O.T.C. He was gazetted to the R.F.C. in July, and went to the front as an observer early in October. On March 6th he was attacked by five enemy machines and wounded by gunfire, dying soon afterwards. His pilot, who was unhurt, succeeded in landing safely.

Second Lieutenant E. Eric Horn, Middlesex Regiment and R.F.C., whose death is announced, was 19 years of age, and was the fourth son and youngest child of Mrs. Horn, of High Beech, Essex, and the late Mr. John Horn, of Loughton and North Weald, Essex, the well-known poultry breeder and judge. Educated at Loughton School, Essex, he volunteered on his 17th birthday in the Royal Army Medical Corps, and after three months' training proceeded to the front, where, after being gassed, he was given a commission in the Middlesex Regiment, with which unit he went through all the heavy fighting of last year. In December last he was transferred to the R.F.C., still remaining at the front.

Captain the HON. ERIC FOX PITT LUBBOCK, A.S.C. and R.F.C., who was killed on March 11th, aged 23, was the son of the late Lord Avebury and of Lady Avebury and brother of the present baron. He was educated at Eton and Balliol College, Oxford. On the outbreak of war he enlisted in the M.T. section of the A.S.C., with which he went to France in September, 1914. Later he was given a commission in the A.S.C., but soon became attached to the R.F.C., with which

he saw the bulk of his service. He remained at the front as an observer, and was awarded a Military Cross for conspicuous gallantry and was twice mentioned in despatches. He returned to England and, obtaining his pilot's certificate, was retained in this country a short time on instructional work, but last October went back to the front as flight-commander. A memorial service was held in the Grosvenor Chapel, South Audley Street, on Wednesday.

Lieutenant CUTHBERT WILLIAM SHORT, M.C., Indian Army Reserve of Officers, att'd. R.F.C. (killed in action), was awarded the Military Cross in September last year "for conspicuous gallantry and skill. On one occasion, when our cavalry were held up by machine-gun fire, he, with Captain Miller as pilot, came close to the ground, and flew several times along the line of hostile machine-guns, drawing their fire, and engaging them with his Lewis gun, thus enabling the cavalry to advance."

Lieutenant GEORGE KENNETH SIMPSON, R.F.C., who died of wounds on March 7th, aged 26, was the youngest son of the late Henry John Simpson, of Liverpool, and Mrs. Simpson, of Brentwood, Beckenham, Kent, and Vancouver, B.C. Educated at Dulwich College, he went out to Vancouver, and returned home soon after the outbreak of war. He received his commission in the R.G.A. in March, 1915, and in October he went into the R.F.C., being posted to the Kite Balloon Section as observer in March, 1916. He left for the front on May 25th, 1916, and was gazetted Balloon Commander on March 6th last. A brother officer, writing of him, says:—"Simpson's accident was due to his own gallantry . . . in waiting till the air mechanic who was with him was clear of the balloon, which was in flames, before he himself jumped.

If ever a man deserved honour it is dear old Simpson. . . . The flaming balloon suddenly dropped, overtook Simpson, set fire to his parachute, and the whole lot dropped blazing to the ground." This was his second parachute descent.

Lieutenant JOHN THOMPSON, R.F.C., who has been killed in action, was the youngest son of Mr. John Thompson, of West Park, South Shields. He was 22 years of age, and joined the Tyneside "Commercials" soon after the outbreak of war. Lieutenant Thompson had seen service at Gallipoli.

Second Lieutenant JAMES FERGUSON, R.F.C., who has been killed in a flying accident in Yorkshire on March 12th, was 18 years of age, and was the only son of Mr. and Mrs. James Ferguson, of The Cedars, High Wycombe. Educated at Godstowe School, High Wycombe, and Winchester, he left Winchester before completing his school career in order to take a commission in the R.F.C. some months ago. In his school work he was most successful, and was also known as a fine athlete. The funeral took place at Wycombe Parish Church on March 16th, with full military honours.

Lieutenant HAROLD LESLIE LASCELLES, R.F.C., who was killed on March 11th, as the result of a flying accident, was the son of Mrs. Lascelles O'Connell, of Weyholme, West Byfleet. He was 25 years of age, and was educated at St. Paul's School, and on the outbreak of war joined the Inns of Court O.T.C., obtaining a commission in the Yorkshire Regiment in July, 1915. He transferred to the R.F.C. in the following October, and proceeded to Egypt in January, 1916, taking part in several of the operations in that theatre of war. He was promoted Lieut., R.F.C., on April, 1st, 1916, and returned to England in July, 1916. He was just on the eve of proceeding to the front when he was killed.

Married and to be Married.

A marriage has been arranged, and will shortly take place very quietly, between Second Lieutenant GUY W. ARMSTRONG, R.F.C., of Toronto, and GLADYS EVELYN, only child of Major G. L. B. KILLICK, late 60th Rifles, and Mrs. KILLICK, of 31, Finsbury Square, London, E.C.

At the Pro-Cathedral, Captain P. A. O. LEASK, Royal Irish Rifles (att'd. R.F.C.), son of Mr. A. O. Leask and Mrs. Leask, of Toronto, Canada, was married to LILIAS ESMÉ TAAFFE, daughter of the late FRANCIS J. P. GIBSON, Vancouver, B.C., and Mrs. GIBSON, 42, Campden House Court.

On March 13th, at The Red House, Milliken Park, Lieut. STANLEY EVELYN LEWIS, R.F.C., youngest son of Colonel John Lewis, C.M.G., Union Defence Force, S.A., was married

to ELIZABETH SPENCE RIDDALL, daughter of the later John Riddall, M.D., Ayr.

The marriage arranged between Captain (Temporary Lieutenant-Colonel) R. BARRY MARTYN, M.C., R.F.C. and Wiltshire Regiment, and Miss NINA COLQUHOUN, took place on March 14th at St. James's, Wesbourne Terrace.

The engagement is announced, and the marriage will take place in May, between Captain JAMES HUMPHREY COTTON MINCHIN, the Cameronians and R.F.C., only son of Mr. and Mrs. James Cotton Minchin, The Green, Wimbledon Common, and VIOLET, third daughter of Mr. and Mrs. CLAUDE FULLER, and granddaughter of Mr. and Mrs. Beaumont, Buckland Court, Betchworth, Surrey.

It is announced that the marriage has taken place in St. Thomas's Church, New York, of Major Lord GEORGE WELLES-

LEY, M.C., R.F.C., youngest son of the Duke and Duchess of Wellington, with Lady RICHARD WELLESLEY, widow of his brother, Lord Richard Wellesley, Grenadier Guards, who was killed at the first battle of Ypres, 1914. Lady Richard is a daughter of the late Sir Maurice FitzGerald, the twentieth Knight of Kerry, and a granddaughter of Mrs. Bischoffsheim, Bute House, South Audley Street, W. Lord George is at present in Canada in connection with the R.F.C., and it is understood that he and Lady George Wellesley will subsequently take up their residence permanently in the United States.

Items.

VISCOUNTESS COWDRAY has taken several boxes for the Scottish Women's Hospital matinee at the Coliseum for to-morrow (Friday). These boxes she is giving to the men in the Royal Flying Corps Hospital.

SIDE-WINDS.

At one of the home aerodromes a new machine has lately been undergoing its initial tests, and its performances are such as to cause favourable comment, even from people who are used to seeing what our most modern machines can do, and Messrs. F. Nestler, Ltd., have every reason to be proud of this their first-born. Several detail improvements are under way, which will, it is confidently expected, place the machine in the very front rank of aeroplanes of this type. The performance is so much the more creditable as the designer has not before designed a machine of this type. In connection with this excellent performance it should be mentioned that Messrs. F. Nestler, Ltd., have been fortunate in finding an experienced and very skilful pilot in Mr. J. B. Fitzsimons, who has had over a year's flying out at the front. Mr. Fitzsimons took his "ticket" at the Ruffy-Baumann School at Hendon, after a very short period of tuition, in 1915. His handling of the new Nestler 'bus is certainly spectacular, if somewhat daring, and he appears to have absolute mastery of the machine.

BY-THE-BYE, it was at the Ruffy-Baumann School that Capt. Ball graduated in flying, under Mr. Baumann's

masterly tuition; Mr. Virgilio, to whom last week was attributed the teaching of Capt. Ball, was not in at the finish, he having left the Ruffy-Baumann School some time previous to October, 1915, when Capt. Ball took his ticket at Hendon.

By permission of the Ministry of Munitions, Messrs. Palladium Autocars, Ltd., of Felsham Road, Putney, inform us that they are in the lucky position of being able to give immediate or early delivery of their 3-4-ton chassis, and as earnest thereof, send us a list of well-known firms who have recently benefited thereby. It will be remembered that the sole concessionaires are Messrs. Foster and Tattersall, Ltd., 4, Great Marlborough Street, in whose showrooms may now be seen two of these heavy chassis ready for the first names on the list.

REGRET to learn that Sydney Pickles has resigned his position with the Wells Aviation Company, who thereby lose a good man. It is doubtful whether an experienced pilot with the abilities and experience of Pickles will long be left to "rest." It would not only not suit him, but it would be almost a sin just now.

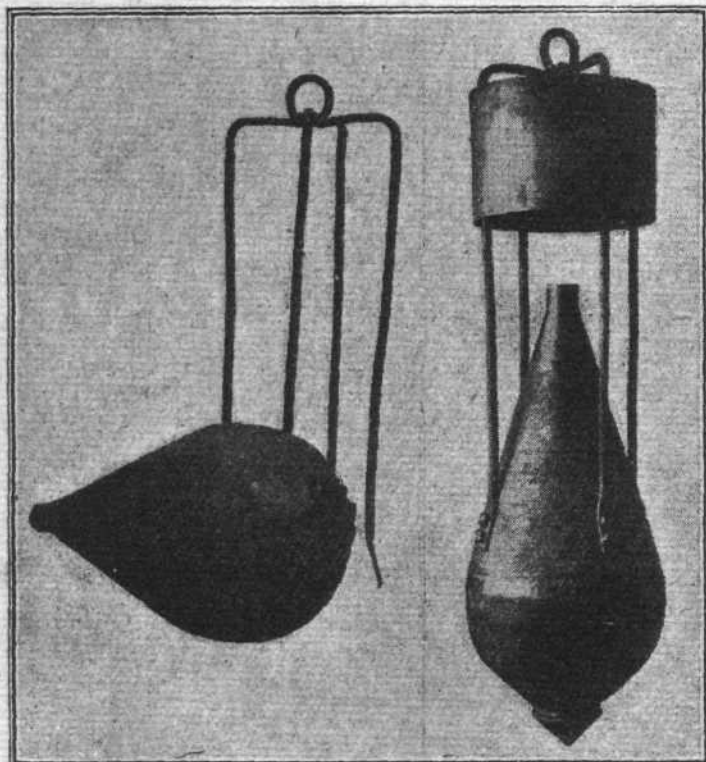


Official photograph issued by the Press Bureau.
A CAPTURED GERMAN AEROPLANE.—Bringing home the spoils.

THE first number of the House Journal of Aircraft Supplies, Ltd., is to hand. The journal is to be issued fortnightly, on Wednesdays, and will be forwarded regularly by post to all manufacturers and those in charge of stores and works and air-service departments, on application to the Secretary, 17, John Street, W.C. The journal contains the company's stock list, and interesting articles and comments concerning aircraft. The number to hand contains, among other things, an interesting article by Douglas W. Thorburn, on "The Art of Compiling Catalogues," written in his well-known satirical and amusing manner. On another page, G. H. Mansfield discourses on things in general. In addition, the same author provides an instructive article on "Raw Material, Stores and Arrangement," with illustrations. A really interesting and instructive little booklet, and one which can be had for the asking, as stated above.

At the annual General Meeting of Messrs. Naylor Brothers (London), Ltd., the well-known varnish manufacturers, of 407-409, Oxford Street, London, W., and Southall, Middlesex, Mr. W. Lionel Naylor, elder son of the late Mr. W. Ernest Naylor, was elected a director of the company. Mr. Lionel Naylor, who enlisted on the outbreak of war, is still serving at the Front in France.

ONE might be given to wonder why it is that the Zenith carburettor is forcing itself so much to the fore in aviation that it would appear to be rapidly becoming an indispensable adjunct to all stationary aero engines, at any rate, in this country and on the Continent. When the facts are known, there is no miracle in it. On the outbreak of war, the Zenith Carburettor Company, knowing that there would be a big demand for these very essential accessories to flying, established laboratories high in the Alps, at altitudes of upwards of 9,000 ft., and carried out experiments as nearly as possible under flying conditions, thereby obtaining most valuable data. It was found, for instance, that at an altitude of 6,000 ft., the carburettor, as set for sea-level, delivered 10 per cent. too much petrol. Naturally, they set about to devise some method of regulating the flow at varying altitudes, and the aero Zenith of to-day is the result. That this is appreciated in France, is clearly shown by the fact that for all aero engines made there, with the exception of those of rotary type, the Zenith is a standard fitting, and the same conditions appear to be rapidly coming in this side of the ditch.



RESTORING A ZEPP. BOMB.—Many and varied are the jobs which arrive at the Barimar works for repair and restoration. Above is seen a Zepp. bomb which was found somewhere in the Eastern Counties, the photo. on the left showing the remains of the bomb after it had exploded, while on the right it is seen restored to its original shape by the Barimar scientific welding experts.

It is hard to have to make three bites at a cherry, but in order to set matters right, the makers of "The Dope Brush," referred to in these notes last week, are John Hall and Sons (Bristol and London), Ltd., and not simply John Hall and Sons, Ltd. This correction will be hardly necessary to our, and their, many friends in the motor and allied industries, but it is important that it should be correctly stated.

COMPANY MATTERS.

Frederick Sage and Co., Ltd.

THE report of Frederick Sage and Co., Ltd., for the year ended September 30th last states that after making provision for depreciation, &c., the net profit, subject to special taxation, is £31,098. Adding to this the sum of £5,712 brought forward from last year, a total of £36,810 is available. The directors recommend a dividend of 6 per cent., less income tax, on the ordinary shares, leaving to carry forward £23,307.

NEW COMPANIES REGISTERED.

Private Companies.

AIRCRAFT TRUST CO., LTD., 90, Cannon Street, E.C.—Capital £100, in £1 shares. Manufacturers of, and dealers in, aircraft, to promote aviation, &c.

BRITISH NATIONAL AVIATION SYNDICATE, LTD., 18, Fleet Street, E.C.—Capital £2,000, in 1,800 preference shares of £1 each and 4,000 deferred shares of 1s. each. Aerodrome proprietors, promoters, financiers, &c.

IMPORTS AND EXPORTS, 1916-1917.

AEROPLANES, airships, balloons, and parts thereof (not shown separately before 1910). For 1910 and 1911 figures, see "FLIGHT" for January 25th, 1912; for 1912 and 1913, see "FLIGHT" for January 17th, 1914; for 1914, see "FLIGHT" for January 15th, 1915; for 1915, see "FLIGHT" for January 13th, 1916; and for 1916, see "FLIGHT" for January 11th, 1917.

	Imports.		Exports.		Re-Exportation.	
	1916.	1917.	1916.	1917.	1916.	1917.
January ...	1,009	10,842	6,399	67,033	Nil.	Nil.
February ...	6,444	9,479	30,693	26,512	—	6
	7,453	20,321	37,092	93,545	—	6

Aeronautical Patents Published.

Applied for in 1915.

Published March 22nd, 1917.

- 13,473. W. S. LAING. Anti-airship projectile.
- 16,787. F. LA ROCHE. Airships.
- 17,981. C. R. AND W. C. SCOTTER. Flying machines; also applicable to propeller for the same, &c.

Applied for in 1916.

The numbers in brackets are those under which the specifications are printed and abridged, &c.

Published, March 15th, 1917.

- 4,105. R. T. SMITH AND J. J. RAWLINGS. Automatic safety device and indicator to minimise accidents to flying machines on grounding. (104,050.)
- 10,975. T. D. KELLY. Aeronautical machines. (104,114.)
- 11,413. R. AND J. DEMPSTER, AND R. DEMPSTER. Retorts employed in the manufacture of hydrogen gas. (104,115.)
- 13,143. F. H. ROYCE, B. I. DAY, AND ROLLS-ROYCE LTD. Landing gear. (104,125.)

Published March 22nd, 1917.

- 7,411. RUDGE-WHITWORTH, LTD., AND J. V. PUGH. Air screw bosses, and their attachment to propeller shafts. (104,277.)

Index and Title Page for Vol. VIII.

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